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Report No. SFIM-AEC-BC-CR-95046

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FINAL

REPORT ON TREATABILITY TEST OF GROUNDWATER BY ULTRAVIOLET (UV)/OXIDATION UMATILLA DEPOT ACTIVITY HERMISTON, OREGON

Contract No. DAAA15-90-D-0015
Delivery Order No. 10

Prepared for:

U.S. ARMY ENVIRONMENTAL CENTER
Aberdeen Proving Ground, Maryland 21010

Prepared by:

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The Report on the Treatability Test of Groundwater by Ultraviolet (UV)/Oxidation has been prepared for the U.S. Army Environmental Center (USAEC), to document the results of the treatability test performed at Umatilla Depot Activity (UMDA), Hermiston, Oregon, during the Site 4 (Explosive Washout Lagoons) pumping tests. It has been prepared for the USAEC under the Base Realignment and Closure (BRAC) Program, and is part of the Remedial Investigation/Feasibility Study (RI/FS) activities being performed at UMDA. The objective of the treatability test was to gather data to evaluate whether UV/ozone is a feasible alternative for effectively removing explosives from groundwater at Site 4. The report presents discussions on the treatment technology, field setup, sampling/analyses, results, and useability. The results indicate that most explosives were effectively treated by UV/ozone, but that 1,3,5-trinitrobenzene (1,3,5-TNB) was difficult to treat. Projected costs for a full-scale treatment system are provided. In addition, an evaluation of a field method for analyzing explosives in groundwater--which was performed in conjunction with the treatability test--is presented.

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LIST OF ACRONYMS AND ABBREVIATIONS

BRAC	Base Realignment and Closure Program
COD	Chemical Oxygen Demand
1,3-DNB	1,3-Dinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
HMX	High Melting Explosive (cyclotetramethylenetetranitramine)
H_2SO_4	Sulfuric acid
HSP	Health and Safety Plan
IRDMIS	Installation Restoration Data Management Information System
lb/day	Pounds per day
mg/L	Milligrams per liter
mg/L/min	Milligrams per liter per minute
mph	Miles per hour
NaOH	Sodium hydroxide
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC	Quality control
RDX	Royal Demolition Explosive (hexahydro-1,3,5-trinitro-1,3,5-triazine)
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SOP	Standard operating procedure
TDS	Total dissolved solids
1,3,5-TNB	1,3,5-Trinitrobenzene
2,4,6-TNT	2,4,6-Trinitrotoluene
TOC	Total organic carbon

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

TSS	Total suspended solids
μg/L	Micrograms per liter
UMDA	Umatilla Depot Activity
USAEC	U.S. Army Environmental Center (formerly USATHAMA)
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
UV	Ultraviolet

1.0 INTRODUCTION

This document is the Report on the Treatability Test of Groundwater by Ultraviolet (UV)/Oxidation for the Supplementary Remedial Investigation/Feasibility Study (RI/FS) at the Umatilla Depot Activity (UMDA), Hermiston, Oregon. It has been prepared for the U.S. Army Environmental Center (USAEC), formerly the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), under the Base Realignment and Closure (BRAC) Program, Contract No. DAAA15-90-D-0015, Delivery Order No. 10. The report describes the treatability test (using UV/ozone) performed during pumping tests at Site 4, Explosive Washout Lagoons.

Field data gathering methods, and protocols for sample handling and analysis were performed according to the Standard Operating Procedures (SOPs) defined in Part B of the RI/FS Project Plan, the Field Sampling Plan (FSP), (Dames & Moore, 1990), and in accordance with an addendum to the FSP (Dames & Moore, 1993a). Fieldwork and chemical analyses were also performed in accordance with the Quality Assurance Project Plan (QAPP), Part C of the RI/FS Project Plan, the Health and Safety Plan (HSP), Part D, and an addendum to the HSP presented in Appendix A of the FSP Addendum (Dames & Moore, 1993a).

The purpose of this report is to document the results of the treatability test performed at UMDA during the Site 4 pumping tests. The objective of the treatability test was to gather data to evaluate whether UV/ozone is a feasible alternative for effectively removing explosives from groundwater at Site 4. This evaluation was performed at the suggestion of the U.S. Environmental Protection Agency (EPA) Region X to add to the database of information about the technology's effectiveness and to support the Feasibility Study (FS) for UMDA groundwater conducted by USAEC in 1993. The test was conducted on groundwater removed from the alluvial aquifer during pumping tests and served to decontaminate the groundwater prior to discharge, as well as to collect treatability data. The treatment goals were to reduce Royal Demolition Explosive (RDX) and 2,4,6-trinitrotoluene (2,4,6-TNT)

concentrations to 2 micrograms per liter ($\mu g/L$) or less, and the remaining explosives to below detectable levels. Note that nitrate/nitrite was not treated by either the UV/ozone system or the carbon units. However, as discussed with EPA Region X, the nitrate/nitrite concentrations are similar to those off-post, due to the agricultural nature (i.e., use of fertilizers) of the surrounding areas.

The pumping tests were conducted to obtain drawdown and recovery data to more fully characterize the hydraulic properties of the unconfined aquifer, and to provide data to aid in the design of any remedial recovery system deemed appropriate as part of the FS. The extended aquifer pumping tests were conducted on three of the alluvial wells at Site 4 (4-1, 4-13, and 4-18). Water from wells 4-1 and 4-13 was used to evaluate the effectiveness of the UV/ozone system; water from well 4-18 was treated only by the carbon units. The results of the pumping tests will be presented in an addendum to the Remedial Investigation (RI) Report (Dames & Moore, 1992), and will not be discussed in this document.

Detailed information on UMDA and Site 4 is presented in the RI Report for UMDA (Dames & Moore, 1992), and is not repeated in this document.

2.0 TREATABILITY TEST METHODS

2.1 TECHNOLOGY DESCRIPTION

UV/oxidation is a relatively new technology that involves the irradiation of wastewater with low- or high-intensity UV light concurrent with ozone and/or hydrogen peroxide dosing to degrade chemical contaminants into simpler, less toxic compounds. When wastewater is irradiated with UV light, the contaminant molecules become highly reactive. Ozone and/or hydrogen peroxide is added to the influent as an oxidant; consequently, the contaminants in the wastewater are rapidly oxidized. If the reaction goes to completion, the final products are carbon dioxide, water, nitrate/nitrite dissolved in the effluent, and salts (if chlorine atoms are present in the wastewater). While some small chain aliphatics may remain in the treated water, these constituents are not toxic and are not regulated.

The UV/oxidation technology was chosen to be evaluated at UMDA because it had been shown to be effective for treating explosives-contaminated groundwater at a few other sites. For example, the results of pilot studies performed at Site F, SuBASE Bangor, Washington (NCEL, 1992), indicated that a UV/ozone system is more efficient than a UV/peroxide system at degrading explosives--particularly 1,3,5-trinitrobenzene (1,3,5-TNB)--in groundwater. However, using UV/oxidation to treat explosives-contaminated groundwater is a relatively new approach. The effectiveness of the treatment can depend largely on the type of UV unit being used and the chemistry of the groundwater. Therefore, a pilot study at UMDA was performed to furnish cost and treatment effectiveness information for the UV/oxidation remedial alternative being considered in the FS for groundwater at UMDA. A UV/ozone system--supplied by Ultrox, Santa Ana, California--was evaluated as part of the current study.

The Ultrox UV/ozone system utilizes UV light and ozone to destroy organic compounds in water. Untreated water enters the 6500-gallon influent equalization tank and is pumped to the UV/ozone treatment tank through a flow meter on the

inlet spool. Water flows through the UV treatment tank in a sinusoidal and serpentine pathway, which is created by baffles within the tank. Ozone is produced from air by a 28 pounds per day (lb/day) ozone generator. The air is compressed, filtered, and dried by the Ultrox air preparation system prior to injection into the ozone generator. The ozone is produced at a concentration of approximately 2% in air and flows from the ozone generator to the ozone distribution manifold on the UV treatment tank. From the ozone distribution manifold, the ozone flows through rotometers to spargers located in the bottom of each cell within the UV treatment tank. The spargers diffuse the ozone through the water within the treatment tank where it reacts with UV to form a highly oxidative environment. It is this environment that destroys the chemical bonds of the organic compounds. Any residual ozone that collects within the UV treatment tank above the water surface is destroyed by a catalyst-based ozone destruction unit called a Decompozon™. A diagram of the Ultrox UV/ozone system that was used during the treatability test is shown in Figure 2-1.

2.2 METHODS

2.2.1 Bench-Scale Study

Prior to field mobilization, Ultrox performed a laboratory bench-scale study on a 2-gallon sample of groundwater collected from well 4-1. The purpose of this study was to evaluate the need for metals or other pretreatment and to establish preliminary operating conditions (e.g., color testing for light transmission, pH testing for pH adjustment). Ultrox characterized the groundwater by analyzing for the following parameters using the indicated EPA analytical methods:

- Color (EPA 110.2)
- pH (EPA 150.1)
- Iron (EPA 236.2) and Manganese (EPA 243.2)
- Chlorides (EPA 325.3)
- Chemical Oxygen Demand (COD) (EPA 410.1)

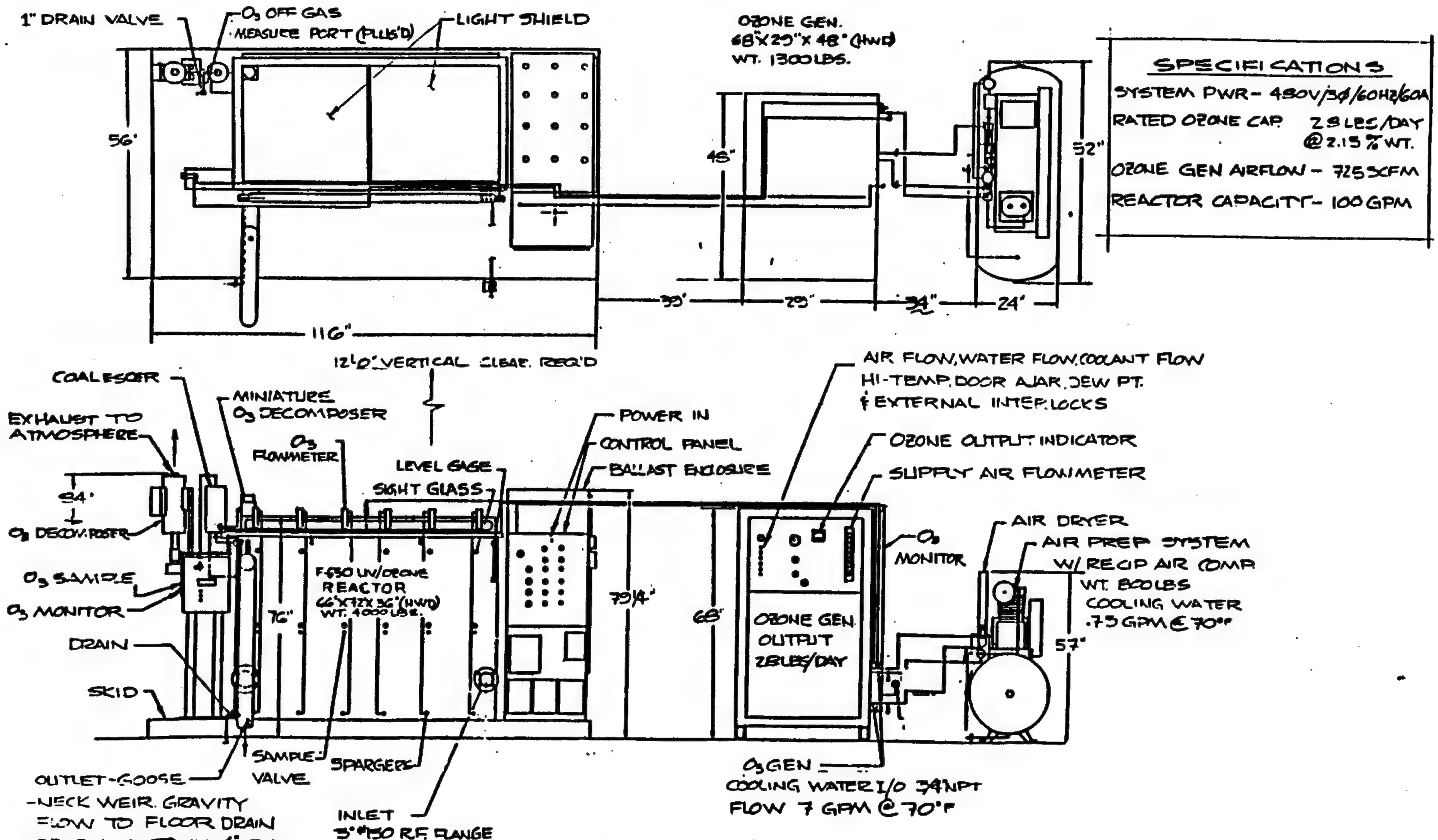


FIGURE 2-1

F-650 & 0-28 UV/WATER TREATMENT SYSTEM

- Total Organic Carbon (TOC) (EPA 415.1)
- Total Dissolved Solids (TDS) (EPA 160.1)
- Total Suspended Solids (TSS) (EPA 160.2)
- Alkalinity (EPA 310.1)
- Turbidity (EPA 180.1).

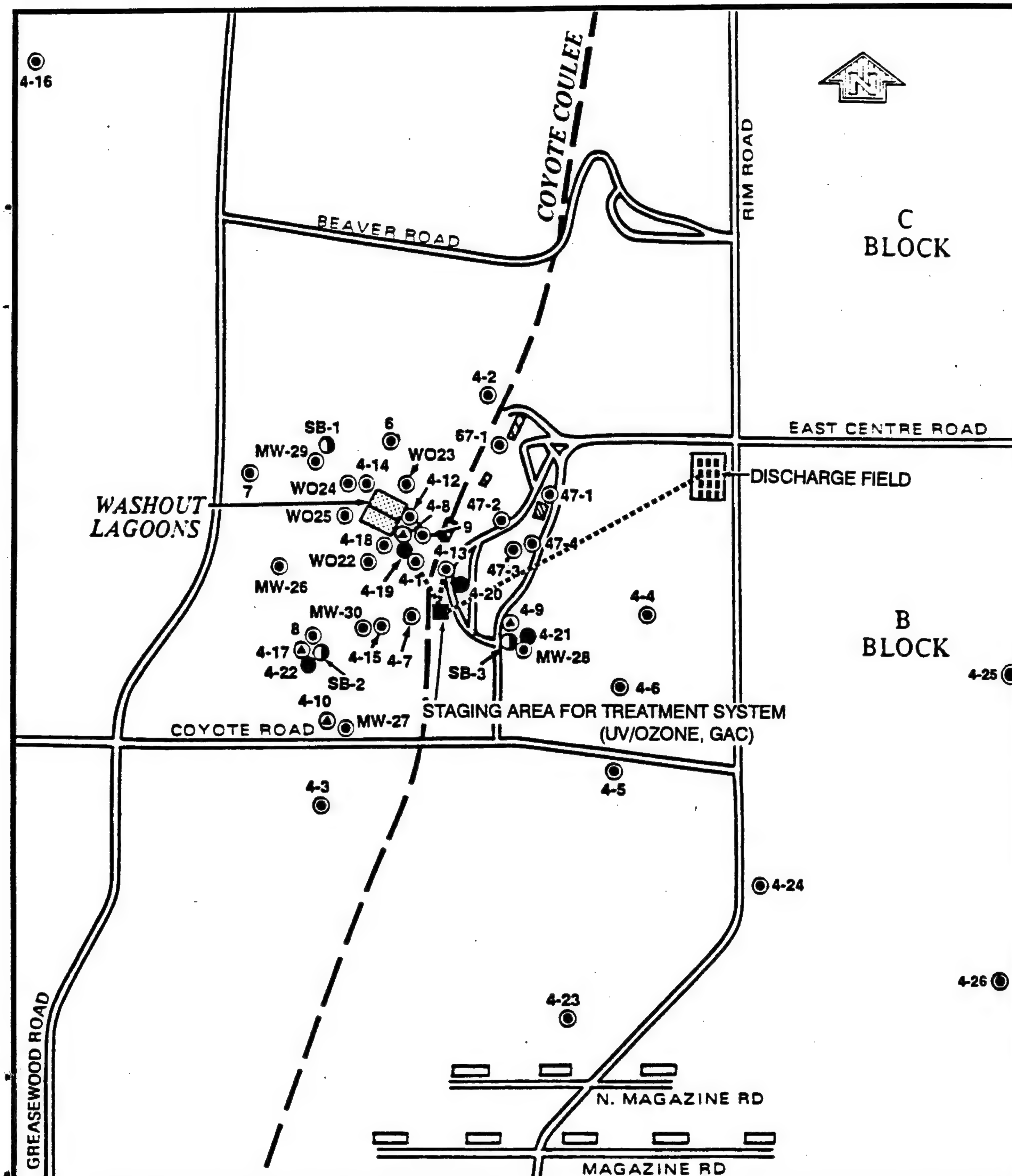
Based on the results of this characterization (presented in Appendix A), pretreatment was determined to be unnecessary for the treatability test.

2.2.2 Field Setup

The treatability test equipment was set up in one location on the top of Coyote Coulee near well 4-13 (see Figure 2-2). The pumps in wells 4-1 and 4-13 (the pumping test wells) were individually plumbed to the treatability test staging area. Water was directed to a 6,500-gallon equalization tank and then the UV/ozone system, or bypassed the system directly to the carbon units. The equalization tank provided sufficient storage for the pumping test groundwater so that the flow rate into the UV/ozone system could be varied. The bypass was necessary to treat any surplus water that the treatability test could not handle (particularly during the low-flow treatment conditions, as discussed in Section 2.2.3, or in case the UV/ozone system failed) so as not to interfere with the pumping tests. The water from the UV/ozone system was also piped to the carbon units, to ensure that all water had been sufficiently treated prior to discharge.

2.2.3 Test Parameters

Design parameters that were evaluated during the treatability test were pH, ozone dosage, and retention time. During each of the two pumping tests, three pH levels and three ozone dosages were evaluated (nine studies per pumping test). The pH values that were investigated were 5, 7 (neutral, or natural groundwater pH), and 9; the three ozone dosages that were evaluated were 1.5, 2.5, and 3.5 milligrams per liter per minute (mg/L/min). (Note that--at the retention times that were evaluated as part of the test (see below)--the UV/ozone system had an ozone dosage



LEGEND:
- Monitoring Well Completed in Alluvium
- Monitoring Well Completed in First Basalt Flow
- Monitoring Well Completed in First Interbed
- Monitoring Well Completed in Second Interbed
- .... Piping for Treatability Study

NOT TO SCALE

FIGURE 2-2
FIELD SETUP OF PUMP TEST, TREATABILITY TEST, AND DISCHARGE FIELD

UV
2-5

Dames & Moore

capacity of 3.6 mg/L/min.) These values were based on treatability studies performed at other locations (ICF, 1993; NCEL, 1992), Ultrox's experience with treating explosives-contaminated water, and the results of the bench-scale study.

The approach to raising the pH involved metering a 20% sodium hydroxide (NaOH) solution into the influent line of the UV/ozone treatment tank. The metering volume and rate was determined by field experiment prior to starting the treatability test. The experiment was conducted by collecting a 5-gallon sample and adding NaOH solution until the desired pH was achieved. The pH was monitored by a pH meter. The volume added was scaled up based on the flow of groundwater to the Ultrox system. The same procedure was followed for lowering the pH, but a solution of 10% sulfuric acid (H_2SO_4) was used.

In addition to varying the pH and ozone dosages, three retention times--30, 90, and 150 minutes--were evaluated for each of the nine studies, for a total of 27 treatment conditions per pumping test. These retention times were based on Ultrox's experience with treating similar wastewater and on the results of the bench-scale study. The different retention times were achieved by varying the flow rate of the groundwater to the UV/ozone system. Each of the 27 treatment conditions per pump test was run for approximately 3 hours after which samples were collected for chemical analysis (see Section 2.2.4). A summary of the treatability test treatment conditions is presented in Table 2-1. The logs documenting the actual system settings are presented in Appendix B.

In addition to the 27 UV/ozone tests per pumping test, three ozone/hydrogen peroxide tests per pumping test were run, per request of USAEC. The UV lamps were shut off, and an ozone dose of 3.5 mg/L/min, pH of 7, and hydrogen peroxide dose of 1.2 milligrams per liter (mg/L) were run at three retention times: 30, 90, and 150 minutes. Similar to the UV/ozone tests, each of the ozone/hydrogen peroxide tests were run for approximately 3 hours after which samples were collected for chemical analysis (see Section 2.2.4). The ozone/hydrogen peroxide treatment conditions are also summarized in Table 2-1.

TABLE 2-1
Treatability Test Treatment Conditions

Test No.	Time well 4-1	Time well 4-13	Flow Rate (gpm)	Retention Time (min)	Ozone (mg/L/min)	pH	Hydrogen Peroxide (mg/L)	Samples (a)
DAY 1								
--	--	--	--	--	--	--	--	1 (b)
1	10:45 - 14:54	11:45 - 14:45	4.3	150	1.5	7	--	3
2	15:15 - 18:15	15:05 - 18:05	7.2	90	1.5	7	--	3
3	18:35 - 21:35	18:15 - 21:15	21.6	30	1.5	7	--	3
4	22:00 - 01:00	21:30 - 00:30	4.3	150	2.5	7	--	3
5	01:35 - 04:35	01:00 - 04:00	7.2	90	2.5	7	--	3
DAY 2								
6	04:55 - 07:55	04:15 - 07:15	21.6	30	2.5	7	--	3
7	08:15 - 11:15	07:30 - 10:30	4.3	150	3.5	7	--	3
8	01:30 - 04:30	10:45 - 13:45	7.2	90	3.5	7	--	3
9	05:00 - 08:00	13:55 - 16:55	21.6	30	3.5	7	--	3
10	11:00 - 14:00	19:15 - 22:15	4.3	150	1.5	5	--	3
11	14:30 - 17:30	22:45 - 01:45	7.2	90	1.5	5	--	3
DAY 3								
12	17:45 - 20:45	02:10 - 05:10	21.6	30	1.5	5	--	3
13	21:00 - 24:00	05:30 - 08:30	4.3	150	2.5	5	--	3
14	01:05 - 04:05	09:00 - 12:00	7.2	90	2.5	5	--	3
15	04:35 - 06:35	12:20 - 15:20	21.6	30	2.5	5	--	3
16	07:05 - 10:05	15:40 - 18:40	4.3	150	3.5	5	--	3
17	10:20 - 13:20	19:00 - 22:00	7.2	90	3.5	5	--	3
18	13:50 - 15:50	22:10 - 01:10	21.6	30	3.5	5	--	3
DAY 4								
19	17:30 - 20:30	08:00 - 11:00	4.3	150	1.5	9	--	3
20	21:00 - 24:00	11:20 - 14:20	7.2	90	1.5	9	--	3
21	00:50 - 03:50	14:35 - 17:35	21.6	30	1.5	9	--	3
22	04:30 - 07:30	17:45 - 20:45	4.3	150	2.5	9	--	3
23	08:05 - 11:05	21:05 - 00:05	7.2	90	2.5	9	--	3
24	11:35 - 14:35	00:40 - 02:40 *	21.6	30	2.5	9	--	3
25	15:05 - 18:05	03:00 - 06:00	4.3	150	3.5	9	--	3
DAY 5								
26	18:25 - 21:25	11:00 - 14:00	7.2	90	3.5	9	--	3
27	21:50 - 00:55	14:15 - 17:15	21.6	30	3.5	9	--	3
28	16:00 - 19:00	17:55 - 20:55	4.3	150	3.5	7	1.2	3
29	19:15 - 22:15	21:20 - 00:20	7.2	90	3.5	7	1.2	3
30	22:45 - 01:45	00:50 - 03:50	21.6	30	3.5	7	1.2	3
DAY 6								
--	--	--	--	--	--	--	--	3(c)

Total Samples/Pumping Test: 94
Field Duplicates: 5

(a) Samples were collected after each treatment condition was run for approximately 3 hours. At that time, samples were collected at influent (i.e., pretreatment), post UV/ozone system but before carbon treatment, and post carbon treatment, for a total of 3 samples after each treatment condition. Samples were split and one sent to the laboratory for explosives and nitrate/nitrite analyses, and the other analyzed by the field method for 2,4,6-TNT and RDX.
(b) One sample was collected at the start of the pumping test at the pump discharge only.
(c) Samples were collected approximately 30 minutes prior to the end of the pumping test from the influent, post UV/Ozone system and postcarbon treatment.
* Daylight savings time began.

2.2.4 Sampling/Analysis During Treatability Test

2.2.4.1 Laboratory Analysis. Groundwater samples were collected and sent to the chemical laboratory for analysis during each of the treatability tests. Analyses were conducted for nitrate/nitrite and the following explosive compounds: nitrobenzene; 1,3-dinitrobenzene (1,3-DNB); 1,3,5-TNB; 2,4-dinitrotoluene (2,4-DNT); 2,6-DNT; 2,4,6-TNT; RDX; High Melting Explosive (HMX); and tetryl. Samples were collected of both treated and untreated groundwater to determine changes in nitrate/nitrite and explosive compounds concentrations with time, and the effectiveness of the UV/ozone system in treating the explosives. In addition, tests for pH and conductivity were conducted in the field for all groundwater samples prior to submittal to the laboratory.

Samples were collected at the following locations:

- At the pump discharge, prior to any treatment (i.e., influent).
- Between the UV/ozone system and the carbon units, after treatment by UV/ozone.
- At the discharge of the carbon units, after both the UV/ozone and carbon filtration (i.e., effluent).

Samples were collected at each of the above locations at the following frequency:

- At the start of each pumping test (at pump discharge only).
- After each treatment condition (see Table 2-1) had been run for 3 hours.
- Approximately 30 minutes prior to the end of each pumping test.

Based on the above sampling frequency, 94 samples were collected during each of the two pumping tests, for a total of 188 samples. As mentioned previously, samples were analyzed for explosives and nitrate/nitrite. Samples associated with each treatment condition are summarized in Table 2-1, as well as the number of

quality control (QC) samples (i.e., 5 duplicates per pumping test). Actual sampling records are presented in Appendix C.

2.2.4.2 Field Analysis. Total concentrations of 2,4,6-TNT and RDX were measured in the field during pumping tests. The purpose of the field analysis was to monitor the effectiveness of the treatment system, assist in adjusting the operation of the UV/ozone system, and follow trends in groundwater quality--on a real-time basis--that may have occurred as a result of pumping. Measurements were carried out using a colorimetric method described in the Method Validation Report (Dames & Moore, 1993) and modified in the field. The modifications are discussed in an Addendum to the Method Validation Report, presented in Appendix D of this document. Samples for field analysis were collected at the same times and locations as for laboratory analysis.

2.2.4.3 Sample Designation. To effectively maintain accurate records of sample locations, treatment conditions, and sample analysis data, a sample designation system was used that was developed in conformance with systems used in previous investigations and USAEC data management requirements and specifications. The sample designation was required, at minimum, to include the sample's location (e.g., the well location number and location in the treatment system), treatment condition, and type of analysis (e.g., laboratory or field). The use of a standardized sample designation system ensured the use of a consistent sample numbering approach by field personnel and a simple, standardized reference for associating sampling results with the various treatment conditions.

Similar to the system used for other investigations of the RI/FS at UMDA, an eight-character sample designation code was used, which was a FIELD SAMPLE NUMBER. (The code is limited to eight alphanumeric characters, the maximum field width for sample site identification numbers in USAEC's Installation Restoration Data Management Information System (IRDMIS).) The UMDA treatability test sample designations included the information summarized in Table 2-2. Note that the time that a sample was collected was recorded in the sample collection log with the

Table 2-2

Sample Designation Summary for
Treatability Test Samples

8-Digit Sample Designation: _ _ _ _ _ _ _ _
Character No.: 1 2 3 4 5 6 7 8

Character No.	Description	Sample Designation Code
1	Sample Matrix -- Groundwater	G
2-3	Well No. -- 4-1 -- 4-13	01 13
4	Sample Location in Treatment System -- Influent (Pretreatment) -- Post UV/Ozone Treatment -- Effluent (Post Carbon Treatment)	 I U E
5-6	Treatment Condition -- Start of pumping test (at pump discharge) -- 1 to 30 -- 30 minutes prior to the end of pumping test	 00 01 to 30 31
7	Type of Analysis -- Laboratory -- Field	 L F
8	QC Sample Designation -- Field Duplicate	 D

Sample Designation Examples

G01U23LD Duplicate (D) groundwater (G) sample from well 4-1 (01), post UV/ozone treatment (U), twenty-third treatment condition (23), laboratory analysis (L).

G13E16F Groundwater (G) sample from well 4-13 (13), post carbon treatment (E), sixteenth treatment condition (16), field analysis.

treatment condition number; this information could not be included in the eight-digit sample designation code, nor in IRDMIS in conjunction with other information (e.g., sample data). However, the time that a sample was collected was not considered as critical as the treatment condition in the sample designation code; time is included in the results tables in Section 3.0 of this report. Also note that the samples collected at the start and near the end of each pumping test were given treatment condition numbers of 00 and 31, respectively.

2.2.5 Carbon Adsorption Units

Because some contaminant residuals could be present in the UV/ozone system effluent at different times during the treatability test (depending upon the pH and UV/ozone doses applied), and because at the longer retention times the UV/ozone system could not handle all the water from the pumping test, carbon adsorption was used downstream of the UV/ozone unit to polish the effluent water and as a bypass to the UV/ozone system to ensure that the water discharged to the environment was fully treated. Carbon adsorption had been used previously for groundwater treatment during pumping tests at Site 4, and was found to be effective in treating the groundwater.

The effluent water from the UV/ozone system was pumped to a 4,500-gallon tank and then through the carbon units. Three two-unit systems in parallel were hooked up, so that 1 to 2 systems could be used (depending on the flow rate from the pumping test), and 1 system could be used for backup in case a system failed. The six carbon adsorption canisters (ones already onsite from previous pumping tests) were set on the ground near the UV/ozone system. The six units were connected using 2-inch polyvinyl chloride (PVC) pipe, in a series-parallel arrangement; that is, three pairs of tanks, with two tanks connected in series, were connected in parallel. The water was treated/polished by the carbon units, and flowed from the carbon units to a simple drip-irrigation system to the ground surface for discharge (see Section 2.2.6). As discussed in Section 2.2.4, the treated water was sampled prior to discharge.

2.2.6 Discharge System

The discharge system consisted of PVC piping from the carbon units, a poly tank, an in-line booster pump, and four PVC discharge lines in a discharge field. From the carbon units, treated water was pumped northeastward, to the southwest quadrant of the East Centre Road and Rim Road intersection. At this location, four discharge lines were joined together by a manifold. The manifold consisted of solid PVC pipe with elbows or tees used to connect the discharge lines. The discharge lines were constructed of PVC pipe, capped at the end, and slotted on the top portion only to allow water to fill the entire length of the line before discharging. Each discharge line was 20 feet long. The treated effluent flowed from the carbon units, through the discharge network, and trickled onto the ground surface, where the wastewater infiltrated into the soil and evaporated. In this manner, the groundwater from the pumping tests was treated and disposed of away from each wellhead, so as not to interfere with the pumping tests.

3.0 TREATABILITY TEST RESULTS AND EVALUATION

This section presents the results of the bench-scale study and treatability test performed at wells 4-1 and 4-13 at Site 4, and evaluates the effectiveness and usability of the UV/ozone system.

3.1 RESULTS OF BENCH-SCALE STUDY

The results of Ultrox's bench-scale study are discussed in detail in the Ultrox Report, presented in Appendix A. In summary, the study indicated that no pretreatment (e.g., filtration, precipitation) was necessary for the treatability test. The study also provided data on the various treatment parameters, and indicated that the selected pH, ozone dosages, and retention times would provide the information necessary to evaluate the efficacy of the system, and to achieve the treatment objectives for some of the treatment conditions.

3.2 RESULTS OF TREATABILITY TEST

As discussed in Section 2.2.4, samples for the treatability tests were collected after each treatment condition had been run for approximately 3 hours, at which time samples were collected at the influent (i.e., prior to any treatment), after the UV/ozone system but prior to the carbon units, and at the effluent (i.e., at the discharge of the carbon units). The laboratory chemical analysis results are presented in this section. Also, the laboratory results and interpretation by Ultrox are presented in Appendix A. The field analysis results are presented in Appendix D, the Addendum to the Method Development Report.

The chemical analysis results are presented in tables for each well in the results subsections. Data are reported by field ID number in chronological order. Information on the test parameters (i.e., pH, ozone dosage, and retention time) is included in the tables. Note that only compounds that were detected in at least one sample collected during a treatability test are presented in these tables, rather than all constituents analyzed. The chemical results are compared against a set of

comparison criteria developed during the RI (Dames & Moore, 1992) and based on human health standards, where available. The detected concentrations of compounds are compared to the comparison criteria selected for them, and exceedances are flagged on the table by brackets around the listed concentration.

3.2.1 Well 4-1

The treatability test at well 4-1 was started on October 13, 1994, and all 30 treatment conditions were completed by October 21, 1994. As presented in Table 3-1, the initial conditions at well 4-1 (i.e., at the start of the pumping test and prior to any treatment; field ID G01I00L) indicate various concentrations of most of the explosives analyzed for, with 2,4,6-TNT and RDX having the highest concentrations. Also, nitrate/nitrite was detected at a concentration of 22,000 micrograms per liter (μg/L), which did not vary significantly throughout the test.

As expected, 1,3,5-TNB--a breakdown product of other explosives, particularly 2,4,6-TNT--was the most difficult explosive to treat. Although under many of the treatment conditions the other explosives were non-detectable, 1,3,5-TNB still had high concentrations. The concentrations often increased from the influent level to the post-UV/ozone system level, likely due to the treatment of 2,4,6-TNT that results in creating more 1,3,5-TNB, a breakdown product. There were three treatment conditions under which the levels of 1,3,5-TNB were reduced to below the comparison criterion of 1.75 μg/L or were non-detectable. (All other explosives were non-detectable.) The field IDs and associated treatment conditions were as follows:

Field ID	Ozone Dosage (mg/L/min)	Retention Time (min)	pH
G01U13L	2.5	150	5
G01U16L	3.5	150	5
G01U17L	3.5	90	5

TABLE 3-1
Chemical Analysis Results
Treatability Test at Well 4-1

Site 4 Groundwater Data -- 03/15/94 Page # : 1

FIELD ID		G01I00L	G01I01L	G01U01L	G01E01L	G01I02L	G01U02L	G01E02L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		13-oct-1993	13-oct-1993	13-oct-1993	13-oct-1993	13-oct-1993	13-oct-1993	13-oct-1993	
SAMPLE TIME		10:30	14:45	14:45	14:45	18:15	18:15	18:15	
OZONE (mg/L/min.)		n/a	1.5	1.5	1.5	1.5	1.5	1.5	
RETENTION TIME (min.)		n/a	150	150	150	90	90	90	
TEST pH		n/a	7	7	7	7	7	7	
H2O2 (mg/L)		n/a	0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives									
135TNB	*0.449*	[130 C]	[140 C]	[140 C]	LT 0.449	[14.2 C]	[450 C]	LT 0.449	1.75
13DNB	*0.611*	[5.55 C]	[6.64 C]	LT 0.611	LT 0.611	[7.39 C]	2.55 C	LT 0.611	3.5
246TNT	*0.635*	[2900 C]	[3200 C]	LT 0.635	LT 0.635	[3200 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[310 C]	[310 C]	LT 0.064	LT 0.064	[320 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	[14.8 C]	[16 C]	LT 0.074	LT 0.074	[18 C]	LT 0.074	LT 0.074	0.007
HMX	*1.21*	1200 C	270 C	LT 1.21	LT 1.21	950 C	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	12.9 C	12 C	LT 0.645	LT 0.645	[18 C]	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[2600 C]	[2900 C]	LT 1.17	LT 1.17	[2900 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	1.82 C	LT 1.56	LT 1.56	2.12 C	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[22000]	[22000]	[28000]	[48000]	[22000]	[20000]	[38000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 2

FIELD ID		G01I03L	G01U03L	G01E03L	G01I04L	G01U04L	G01E04L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		13-oct-1993	13-oct-1993	13-oct-1993	14-oct-1993	14-oct-1993	14-oct-1993	
SAMPLE TIME		21:35	21:35	21:35	01:00	01:00	01:00	
OZONE (mg/L/min.)		1.5	1.5	1.5	2.5	2.5	2.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[130 C]	[370 C]	LT 0.449	[130 C]	[110 C]	LT 0.449	1.75
13DNB	*0.611*	[7.59 C]	[14.4 C]	LT 0.611	[7.03 C]	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3300 C]	[180 C]	LT 0.635	[3300 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[320 C]	[33 C]	LT 0.064	[320 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	[11.7 C]	LT 0.074	LT 0.074	[8.15 C]	LT 0.074	LT 0.074	0.007
HMX	*1.21*	950 C	790 C	LT 1.21	1300 C	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	12.6 C	1.8 C	LT 0.645	14 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[2900 C]	[39.4 C]	LT 1.17	[3000 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	1.57 C	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[24000]	[22000]	[24000]	[19000]	[26000]	[20000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 3

FIELD ID		G01I05L	G01U05L	G01E05L	G01I06L	G01U06L	G01E06L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		14-oct-1993	14-oct-1993	14-oct-1993	14-oct-1993	14-oct-1993	14-oct-1993	
SAMPLE TIME		04:35	04:35	04:35	07:55	07:55	07:55	
OZONE (mg/L/min.)		2.5	2.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[130 C]	[390 C]	LT 0.449	[120 C]	[700 C]	LT 0.449	1.75
13DNB	*0.611*	[7.71 C]	LT 0.611	LT 0.611	[6.87 C]	[4.67 C]	LT 0.611	3.5
246TNT	*0.635*	[3300 C]	LT 0.635	LT 0.635	[3100 C]	[59.8 C]	LT 0.635	10
24DNT	*0.064*	[320 C]	LT 0.064	LT 0.064	[300 C]	[2.16 C]	LT 0.064	0.18
26DNT	*0.074*	[17.8 C]	LT 0.074	LT 0.074	[14.8 C]	LT 0.074	LT 0.074	0.007
HMX	*1.21*	[2300 C]	LT 1.21	LT 1.21	1200 C	220 C	LT 1.21	1750
NITROBENZENE	*0.645*	12 C	LT 0.645	LT 0.645	13 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3600 C]	LT 1.17	LT 1.17	[2700 C]	[10.8 C]	LT 1.17	10
TETRYL	*2.49*	9.95 C	LT 1.56	LT 1.56	1.92 C	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[18000]	[24000]	[18000]	[19000]	[22000]	[18000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 4

FIELD ID		G01I07L	G01I07LD	G01U07L	G01E07L	
SITE ID		4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	
SAMPLE DATE		14-oct-1993	14-oct-1993	14-oct-1993	14-oct-1993	
SAMPLE TIME		11:15	11:15	11:15	11:15	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		150	150	150	150	
TEST pH		7	7	7	7	
H2O2 (mg/L)		0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives						
135TNB	*0.449*	[120 C]	[130 C]	[56.6 C]	LT 0.449	1.75
13DNB	*0.611*	[6.3 C]	[10 C]	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3100 C]	[3200 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[300 C]	[310 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	[2000 C]	[2400 C]	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	11 C	13 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3200 C]	[3400 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics						
NITRATE/NITRITE	*10*	[20000]	[20000]	[28000]	[19000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 5

FIELD ID		G01I08L	G01U08L	G01E08L	G01I09L	G01U09L	G01E09L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		15-oct-1993	15-oct-1993	15-oct-1993	15-oct-1993	15-oct-1993	15-oct-1993	
SAMPLE TIME		04:30	04:30	04:30	08:00	08:00	08:00	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[180 C]	[450 C]	LT 0.449	[190 C]	[650 C]	LT 0.449	1.75
13DNB	*0.611*	[5.3 C]	LT 0.611	LT 0.611	[6.3 C]	1.86 C	LT 0.611	3.5
246TNT	*0.635*	[3200 C]	LT 0.635	LT 0.635	[3200 C]	[39.7 C]	LT 0.635	10
24DNT	*0.064*	[330 C]	LT 0.064	LT 0.064	[340 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	[2000 C]	LT 1.21	LT 1.21	[1800 C]	LT 12	LT 1.21	1750
NITROBENZENE	*0.645*	10 C	LT 0.645	LT 0.645	14 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3400 C]	LT 1.17	LT 1.17	[3400 C]	7.3 C	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[19000]	[24000]	[19000]	[19000]	[21000]	[18000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page #: 6

FIELD ID		G01I10L	G01U10L	G01E10L	G01I11L	G01U11L	G01E11L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		15-oct-1993	15-oct-1993	15-oct-1993	15-oct-1993	15-oct-1993	15-oct-1993	
SAMPLE TIME		14:00	14:00	14:00	17:30	17:30	17:30	
OZONE (mg/L/min.)		1.5	1.5	1.5	1.5	1.5	1.5	
RETENTION TIME (min.)		150	150	150	90	90	90	
TEST pH		5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[180 C]	[22.9 C]	LT 0.449	[170 C]	[67 C]	LT 0.449	1.75
13DNB	*0.611*	[7.4 C]	LT 0.611	LT 0.611	[5.3 C]	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3600 C]	LT 0.635	LT 0.635	[3000 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[330 C]	LT 0.064	LT 0.064	[310 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	1500 C	LT 1.21	LT 1.21	1400 C	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	14 C	LT 0.645	LT 0.645	LT 3.2	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3400 C]	LT 1.17	LT 1.17	[3000 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[26000]	[24000]	[20000]	[20000]	[32000]	[24000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 7

FIELD ID	CRLs	G01I12L	G01U12L	G01E12L	G01I13L	G01U13L	G01E13L	G01E13LD	COMPARISON CRITERIA
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		15-oct-1993	15-oct-1993	15-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	
SAMPLE TIME		20:45	20:45	20:45	24:00	24:00	24:00	24:00	
OZONE (mg/L/min.)		1.5	1.5	1.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		30	30	30	150	150	150	150	
TEST pH		5	5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	0	
UNITS		UGL	UGL	UGL	UGL	UGL	UGL	UGL	
Explosives									
135TNB	*0.449*	[180 C]	[440 C]	LT 0.449	[170 C]	1.63	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	[6.3 C]	[18.9 C]	LT 0.611	[6.3 C]	LT 0.611	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3200 C]	[97.8 C]	LT 0.635	[3200 C]	LT 0.635	LT 0.635	LT 0.635	10
24DNT	*0.064*	[330 C]	[13 C]	LT 0.064	[330 C]	LT 0.064	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	LT 0.074	0.007
HMX	*1.21*	[1900 C]	LT 12	LT 1.21	1600 C	LT 1.21	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	11 C	1.34 C	LT 0.645	13 C	LT 0.645	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3300 C]	[17.4 C]	LT 1.17	[3300 C]	LT 1.17	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	2.25 C	LT 1.56	LT 7.8	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[20000]	[24000]	[23000]	[34000]	[26000]	[26000]	[26000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 8

FIELD ID		G01I14L	G01U14L	G01E14L	G01I15L	G01U15L	G01E15L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	
SAMPLE TIME		04:05	04:05	04:05	06:35	06:35	06:35	
OZONE (mg/L/min.)		2.5	2.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[180 C]	[8.18 C]	LT 0.449	[160 C]	[600 C]	LT 0.449	1.75
13DNB	*0.611*	[6.8 C]	LT 0.611	LT 0.611	[6.3 C]	1.8 C	LT 0.611	3.5
246TNT	*0.635*	[3100 C]	LT 0.635	LT 0.635	[3200 C]	[29.3 C]	LT 0.635	10
24DNT	*0.064*	[320 C]	LT 0.064	LT 0.064	[330 C]	[0.332 C]	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	[1800 C]	LT 1.21	LT 1.21	1500 C	LT 12	LT 1.21	1750
NITROBENZENE	*0.645*	[19 C]	LT 0.645	LT 0.645	14 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3300 C]	LT 1.17	LT 1.17	[3200 C]	5.23 C	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[20000]	[24000]	[22000]	[20000]	[22000]	[22000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 9

	CRLs	G01I16L	G01U16L	G01E16L	G01I17L	G01U17L	G01E17L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	
SAMPLE TIME		10:05	10:05	10:05	13:20	13:20	13:20	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		150	150	150	90	90	90	
TEST pH		5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	COMPARISON
UNITS	CRLs	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[170 C]	LT 0.449	LT 0.449	[170 C]	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	[6.3 C]	LT 0.611	LT 0.611	[11 C]	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3100 C]	LT 0.635	LT 0.635	[3100 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[320 C]	LT 0.064	LT 0.064	[320 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	1500 C	LT 1.21	LT 1.21	1100 C	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	12 C	LT 0.645	LT 0.645	14 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[2900 C]	LT 1.17	LT 1.17	[2900 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[19000]	[26000]	[22000]	[22000]	[26000]	[22000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 10

	CRLs							COMPARISON CRITERIA
FIELD ID		G01I18L	G01U18L	G01E18L	G01I19L	G01U19L	G01E19L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	16-oct-1993	
SAMPLE TIME		15:50	15:50	15:50	20:30	20:30	20:30	
OZONE (mg/L/min.)		3.5	3.5	3.5	1.5	1.5	1.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		5	5	5	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS		UGL	UGL	UGL	UGL	UGL	UGL	
Explosives								
135TNB	*0.449*	[160 C]	250 C	LT 0.449	[160 C]	[330 C]	LT 0.449	1.75
13DNB	*0.611*	[6.3 C]	LT 0.611	LT 0.611	[6.3 C]	[7.92 C]	LT 0.611	3.5
246TNT	*0.635*	[1100 C]	5.42 C	LT 0.635	[1800 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[130 C]	LT 0.064	LT 0.064	[200 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	480 C	LT 1.21	LT 1.21	750 C	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	11 C	LT 0.645	LT 0.645	13 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[1300 C]	1.29 C	LT 1.17	[1900 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[20000]	[24000]	[26000]	[20000]	[24000]	[19000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 11

FIELD ID		G01I20L	G01U20L	G01U20LD	G01E20L	G01I21L	G01U21L	G01E21L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	
SAMPLE TIME		24:00	24:00	24:00	24:00	03:50	03:50	03:50	
OZONE (mg/L/min.)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	
RETENTION TIME (min.)		90	90	90	90	30	30	30	
TEST pH		9	9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives									
135TNB	*0.449*	[160 C]	[430 C]	[430 C]	LT 0.449	[160 C]	[330 C]	LT 0.449	1.75
13DNB	*0.611*	[6.8 C]	[16.4 C]	[16.7 C]	LT 0.611	[6.8 C]	[20.1 C]	LT 0.611	3.5
246TNT	*0.635*	[1900 C]	LT 0.635	LT 0.635	LT 0.635	[930 C]	[130 C]	LT 0.635	10
24DNT	*0.064*	[220 C]	[0.429 C]	[0.449 C]	LT 0.064	[130 C]	[59 C]	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	850 C	LT 1.21	LT 1.21	LT 1.21	300 C	LT 30	LT 1.21	1750
NITROBENZENE	*0.645*	9.2 C	LT 0.645	LT 0.645	LT 0.645	[27 C]	1.81 C	LT 0.645	17.5
RDX	*1.17*	[2000 C]	LT 1.17	LT 1.17	LT 1.17	[1200 C]	[23.5 C]	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[20000]	[24000]	[22000]	[20000]	[20000]	[20000]	[22000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 12

FIELD ID	CRLs	G01I22L	G01U22L	G01E22L	G01I23L	G01U23L	G01E23L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	
SAMPLE TIME		07:30	07:30	07:30	11:05	11:05	11:05	
OZONE (mg/L/min.)		2.5	2.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		150	150	150	90	90	90	
TEST pH		9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	CRLs	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	0.449	[160 C]	[380 C]	LT 0.449	[160 C]	[580 C]	LT 0.449	1.75
13DNB	0.611	[5.8 C]	0.841 C	LT 0.611	[6.8 C]	2.99 C	LT 0.611	3.5
246TNT	0.635	[1600 C]	LT 0.635	LT 0.635	[2000 C]	LT 0.635	LT 0.635	10
24DNT	0.064	[190 C]	LT 0.064	LT 0.064	[240 C]	LT 0.064	LT 0.064	0.18
26DNT	0.074	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	1.21	650 C	LT 1.21	LT 1.21	750 C	LT 1.21	LT 1.21	1750
NITROBENZENE	0.645	10 C	LT 0.645	LT 0.645	11 C	LT 0.645	LT 0.645	17.5
RDX	1.17	[1900 C]	LT 1.17	LT 1.17	[2100 C]	LT 1.17	LT 1.17	10
TETRYL	2.49	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	10	[19000]	[19000]	[26000]	[19000]	[26000]	[20000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 13

FIELD ID		G01I24L	G01U24L	G01E24L	G01I25L	G01U25L	G01E25L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	17-oct-1993	
SAMPLE TIME		14:35	14:35	14:35	18:05	18:05	18:05	
OZONE (mg/L/min.)		2.5	2.5	2.5	3.5	3.5	3.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[160 C]	[530 C]	LT 0.449	[160 C]	[150 C]	LT 0.449	1.75
13DNB	*0.611*	[6.8 C]	[14.7 C]	LT 0.611	[6.8 C]	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3100 C]	[63.6 C]	LT 0.635	[2000 C]	LT 0.635	LT 0.635	10
24DNT	*0.064*	[320 C]	[15.1 C]	LT 0.064	[220 C]	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	1200 C	LT 30	LT 1.21	850 C	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	[20 C]	0.944 C	LT 0.645	LT 3.2	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[2900 C]	[10.4 C]	LT 1.17	[2000 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[22000]	[24000]	[20000]	[22000]	[27000]	[28000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 14

FIELD ID		G01I26L	G01U26L	G01E26L	G01I27L	G01I27LD	G01U27L	G01E27L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		17-oct-1993	17-oct-1993	17-oct-1993	18-oct-1993	18-oct-1993	18-oct-1993	18-oct-1993	
SAMPLE TIME		21:25	21:25	21:25	00:55	00:55	00:55	00:55	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		90	90	90	30	30	30	30	
TEST pH		9	9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives									
135TNB	*0.449*	[150 C]	[250 C]	LT 0.449	[160 C]	[160 C]	[680 C]	LT 0.449	1.75
13DNB	*0.611*	[6.8 C]	LT 0.611	LT 0.611	[6.3 C]	[5.8 C]	1.95 C	LT 0.611	3.5
246TNT	*0.635*	[1600 C]	LT 0.635	LT 0.635	[3100 C]	[3100 C]	[14.4 C]	LT 0.635	10
24DNT	*0.064*	[180 C]	LT 0.064	LT 0.064	[320 C]	[330 C]	[0.38 C]	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	LT 0.37	LT 0.37	LT 0.074	LT 0.074	0.007
HMX	*1.21*	700 C	LT 1.21	LT 1.21	[2000 C]	[2200 C]	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	[29 C]	LT 0.645	LT 0.645	[18 C]	11 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[1900 C]	LT 1.17	LT 1.17	[3100 C]	[3000 C]	2.63 C	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[24000]	[20000]	[26000]	[22000]	[19000]	[19000]	[22000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 15

FIELD ID		G01I28L	G01U28L	G01E28L	G01I29L	G01U29L	G01E29L	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		18-oct-1993	18-oct-1993	18-oct-1993	18-oct-1993	18-oct-1993	18-oct-1993	
SAMPLE TIME		19:00	19:00	19:00	22:15	22:15	22:15	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		150 wo/UV	150 wo/UV	150 wo/UV	90 wo/UV	90 wo/UV	90 wo/UV	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		1.2	1.2	1.2	1.2	1.2	1.2	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[160 C]	[220 C]	LT 0.449	[160 C]	[220 C]	LT 0.449	1.75
13DNB	*0.611*	[5.3 C]	LT 0.611	LT 0.611	[6.8 C]	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3300 C]	[330 C]	LT 0.635	[3300 C]	[350 C]	LT 0.635	10
24DNT	*0.064*	[310 C]	[0.318 C]	LT 0.064	[310 C]	[0.31 C]	LT 0.064	0.18
26DNT	*0.074*	LT 0.37	LT 0.074	LT 0.074	[14 C]	LT 0.074	LT 0.074	0.007
HMX	*1.21*	1600 C	960 C	LT 1.21	1400 C	460 C	LT 1.21	1750
NITROBENZENE	*0.645*	9.2 C	LT 0.645	LT 0.645	14 C	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3200 C]	[820 C]	LT 1.17	[3200 C]	[880 C]	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[20000]	[24000]	[19000]	[20000]	[24000]	[22000]	10000

Table 3-1 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 16

FIELD ID		G01I30L	G01U30L	G01E30L	G01I31L	G01U31L	G01E31L	G01E31LD	
SITE ID		4-1	4-1	4-1	4-1	4-1	4-1	4-1	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		19-oct-1993	19-oct-1993	19-oct-1993	21-oct-1993	21-oct-1993	21-oct-1993	21-oct-1993	
SAMPLE TIME		01:45	01:45	01:45	06:30	06:30	06:30	06:30	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		30 wo/UV	30 wo/UV	30 wo/UV	150	150	150	150	
TEST pH		7	7	7	7	7	7	7	
H2O2 (mg/L)		1.2	1.2	1.2	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives									
135TNB	*0.449*	[160 C]	[320 C]	LT 0.449	[150 C]	[260 C]	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	[5.8 C]	LT 0.611	LT 0.611	[6.3 C]	LT 0.611	LT 0.611	LT 0.611	3.5
246TNT	*0.635*	[3200 C]	[720 C]	LT 0.635	[3100 C]	LT 0.635	LT 0.635	LT 0.635	10
24DNT	*0.064*	[300 C]	[0.891 C]	LT 0.064	[300 C]	LT 0.064	LT 0.064	LT 0.064	0.18
26DNT	*0.074*	[13 C]	LT 0.074	LT 0.074	[14 C]	LT 0.074	LT 0.074	LT 0.074	0.007
HMX	*1.21*	1400 C	1300 C	LT 1.21	1300 C	LT 24	LT 1.21	LT 1.21	1750
NITROBENZENE	*0.645*	[29 C]	LT 0.645	LT 0.645	[33 C]	LT 0.645	LT 0.645	LT 0.645	17.5
RDX	*1.17*	[3000 C]	[1400 C]	LT 1.17	[2900 C]	LT 1.17	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[20000]	[22000]	[22000]	[20000]	[26000]	[24000]	[26000]	10000

GT = Greater Than
LT = Less Than
NA = Not Available

ND = Not Detected
NSA = No Standard Available
NT = Not Tested

[ ] = Detected concentration exceeds comparison criterion
C = Confirmed Result
U = Unconfirmed Result

These results indicate that an acidic pH (i.e., 5) assists in the destruction of 1,3,5-TNB; the retention time must be greater than 30 minutes, and possibly at least 90 minutes; and the ozone dosage must be at least 2.5 mg/L/min.

The three tests involving hydrogen peroxide/ozone, and no UV, indicated that this type of treatment is not nearly as effective as UV/ozone. As presented in Table 3-1, the results for these three tests (field IDs G01U28L, G01U29L, and G01U30L) indicated that many of the explosives--not just 1,3,5-TNB--were not well degraded after the hydrogen peroxide/ozone treatment.

Even though most of the UV/ozone treatment conditions did not effectively treat all of the explosives, note that the carbon effectively polished the groundwater such that no detectable concentrations of explosives were discharged to the ground (see effluent results on Table 3-1).

3.2.2 Well 4-13

The treatability test at well 4-13 was started on October 27, 1993, and all treatment conditions were completed by November 2, 1993. As indicated in Table 3-2, the initial operating conditions at well 4-13 indicated that RDX was the principal explosive present in this area that required treatment. Nitrate/nitrite was present at a concentration of 48,000 μg/L. Similar to the test at well 4-1, 1,3,5-TNB was the most persistent explosive to treat. However, there were lower concentrations overall, mainly because there was no 2,4,6-TNT to start with to break down to more 1,3,5-TNB. Under all of the UV/ozone treatment conditions, RDX was effectively treated to below a detectable level. However, 1,3,5-TNB continued to be persistent. The system effectively treated all explosives to below the comparison criteria or the detection limit under six treatment conditions, as listed on page 3-36.

TABLE 3-2
Chemical Analysis Results
Treatability Test at Well 4-13

Site 4 Groundwater Data -- 03/15/94 Page # : 1

	CRLs								COMPARISON CRITERIA
FIELD ID		G13I00L	G13I01L	G13U01L	G13E01L	G13I02L	G13U02L	G13E02L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		27-oct-1993	27-oct-1993	27-oct-1993	27-oct-1993	27-oct-1993	27-oct-1993	27-oct-1993	
SAMPLE TIME		11:10	14:45	14:45	14:45	18:05	18:05	18:05	
OZONE (mg/L/min.)		n/a	1.5	1.5	1.5	1.5	1.5	1.5	
RETENTION TIME (min.)		n/a	150	150	150	90	90	90	
TEST pH		n/a	7	7	7	7	7	7	
H2O2 (mg/L)		n/a	0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	
Explosives									
135TNB	*0.449*	[3.22 C]	[4 C]	[21 C]	LT 0.449	[2.74 C]	[55 C]	LT 0.449	1.75
13DNB	*0.611*	LT 0.611	LT 0.611	LT 0.611	LT 0.611	0.881 C	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	90.2 C	LT 61	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2300 C]	[2400 C]	LT 1.17	LT 1.17	[1200 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[48000]	[44000]	[48000]	[44000]	[48000]	[76000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 2

FIELD ID		G13I03L	G13U03L	G13E03L	G13I04L	G13U04L	G13E04L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		27-oct-1993	27-oct-1993	27-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	
SAMPLE TIME		21:15	21:15	21:15	00:30	00:30	00:30	
OZONE (mg/L/min.)		1.5	1.5	1.5	2.5	2.5	2.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[3.29 C]	[180 C]	LT 0.449	[2.4 C]	[7.44 C]	LT 0.449	1.75
13DNB	*0.611*	0.9 C	[8.08 C]	LT 0.611	LT 0.611	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	LT 61	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2300 C]	LT 1.17	LT 1.17	[2200 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[48000]	[48000]	[44000]	[44000]	[52000]	[31000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 3

	CRLs							COMPARISON CRITERIA
FIELD ID		G13I05L	G13U05L	G13E05L	G13I06L	G13U06L	G13E06L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	
SAMPLE TIME		04:00	04:00	04:00	07:15	07:15	07:15	
OZONE (mg/L/min.)		2.5	2.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS		UGL	UGL	UGL	UGL	UGL	UGL	
Explosives								
135TNB	0.449	[3.08 C]	[60 C]	LT 0.449	[3.16 C]	[140 C]	LT 0.449	1.75
13DNB	0.611	LT 0.611	LT 0.611	LT 0.611	LT 0.611	1.94 C	LT 0.611	3.5
24DNT	0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	1.21	60 1	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	1.17	[2300 C]	LT 1.17	LT 1.17	[2200 C]	LT 1.17	LT 1.17	10
TETRYL	2.49	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	10	[48000]	[48000]	[44000]	[52000]	[52000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 4

	CRLs	G13I07L	G13I07LD	G13U07L	G13E07L	G13I08L	G13U08L	G13E08L	COMPARISON CRITERIA
FIELD ID		G13I07L	G13I07LD	G13U07L	G13E07L	G13I08L	G13U08L	G13E08L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	
SAMPLE TIME		10:30	10:30	10:30	10:30	13:45	13:45	13:45	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		150	150	150	150	90	90	90	
TEST pH		7	7	7	7	7	7	7	
H2O2 (mg/L)		0	0	0	0	0	0	0	
UNITS	CRLs	UGL	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives									
135TNB	*0.449*	[2.8 C]	[3.89 C]	[12.3 C]	LT 0.449	1.71 C	[22 C]	LT 0.449	1.75
13DNB	*0.611*	0.708 C	LT 0.611	LT 0.611	LT 0.611	LT 0.611	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	[0.192 C]	LT 0.064	LT 0.064	0.18
HMX	*1.21*	LT 61	LT 61	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2300 C]	[1900 C]	LT 1.17	LT 1.17	[2400 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[48000]	[44000]	[52000]	[44000]	[44000]	[56000]	[44000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 5

FIELD ID		G13I09L	G13U09L	G13E09L	G13I10L	G13U10L	G13E10L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	28-oct-1993	
SAMPLE TIME		16:55	16:55	16:55	22:15	22:15	22:15	
OZONE (mg/L/min.)		3.5	3.5	3.5	1.5	1.5	1.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		7	7	7	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[2.32 C]	[120 C]	LT 0.449	[2.68 C]	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	LT 0.611	LT 0.611	LT 0.611	LT 0.611	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	LT 61	LT 12	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2400 C]	LT 12	LT 1.17	[2300 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[44000]	[48000]	[44000]	[44000]	[44000]	[44000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 6

FIELD ID		G13I11L	G13U11L	G13E11L	G13I12L	G13U12L	G13E12L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	
SAMPLE TIME		01:45	01:45	01:45	05:10	05:10	05:10	
OZONE (mg/L/min.)		1.5	1.5	1.5	1.5	1.5	1.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[2.89 C]	0.764 C	LT 0.449	[2.21 C]	[76 C]	LT 0.449	1.75
13DNB	*0.611*	1.04 C	LT 0.611	LT 0.611	0.714 C	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	31 C	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2400 C]	LT 1.17	LT 1.17	[2300 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[44000]	[52000]	[44000]	[44000]	[48000]	[44000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 7

FIELD ID		G13I13L	G13U13L	G13E13L	G13E13LD	G13I14L	G13U14L	G13E14L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	
SAMPLE TIME		08:30	08:30	08:30	08:30	12:00	12:00	12:00	
OZONE (mg/L/min.)		2.5	2.5	2.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		150	150	150	150	90	90	90	
TEST pH		5	5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives									
135TNB	*0.449*	[1.97 C]	LT 0.449	LT 0.449	LT 0.449	[3.27 C]	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	0.928 C	LT 0.611	LT 0.611	LT 0.611	0.892 C	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	LT 61	LT 1.21	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2100 C]	LT 1.17	LT 1.17	LT 1.17	[2300 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[48000]	[48000]	[40000]	[40000]	[44000]	[48000]	[44000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 8

FIELD ID		G13I15L	G13U15L	G13E15L	G13I16L	G13U16L	G13E16L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	29-oct-1993	
SAMPLE TIME		15:20	15:20	15:20	18:40	18:40	18:40	
OZONE (mg/L/min.)		2.5	2.5	2.5	3.5	3.5	3.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[3.48 C]	[29.9 C]	LT 0.449	[1.92 C]	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	LT 0.611	LT 0.611	LT 0.611	0.962 C	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	LT 61	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2300 C]	LT 1.17	LT 1.17	[950 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[44000]	[44000]	[48000]	[44000]	[52000]	[40000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 9

FIELD ID		G13I17L	G13U17L	G13E17L	G13I18L	G13U18L	G13E18L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		29-oct-1993	29-oct-1993	29-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	
SAMPLE TIME		22:00	22:00	22:00	01:10	01:10	01:10	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		5	5	5	5	5	5	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[2.01 C]	LT 0.449	LT 0.449	[1.99 C]	[4.9 C]	LT 0.449	1.75
13DNB	*0.611*	0.834 C	LT 0.611	LT 0.611	0.88 C	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	LT 61	LT 1.21	LT 1.21	LT 61	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2300 C]	LT 1.17	LT 1.17	[2300 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	1.84 C	LT 1.56	LT 1.56	1.77 C	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[48000]	[48000]	[44000]	[44000]	[44000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 10

FIELD ID		G13I19L	G13U19L	G13E19L	G13I20L	G13U20L	G13U20LD	G13E20L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	
SAMPLE TIME		11:00	11:00	11:00	14:20	14:20	14:20	14:20	
OZONE (mg/L/min.)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	
RETENTION TIME (min.)		150	150	150	90	90	90	90	
TEST pH		9	9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives									
135TNB	*0.449*	[5 C]	[37.8 C]	LT 0.449	[2.9 C]	[100 C]	[96 C]	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	[5.64 C]	LT 0.611	LT 3.1	[5.87 C]	[5.97 C]	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.064	LT 0.064	LT 0.32	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	21 C	LT 1.21	LT 1.21	32 C	LT 1.21	LT 1.21	LT 1.21	1750
RDX	*1.17*	[1300 C]	LT 1.17	LT 1.17	[2300 C]	LT 1.17	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[48000]	[52000]	[48000]	[48000]	[48000]	[48000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 11

FIELD ID		G13I21L	G13U21L	G13E21L	G13I22L	G13U22L	G13E22L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	30-oct-1993	
SAMPLE TIME		17:35	17:35	17:35	20:45	20:45	20:45	
OZONE (mg/L/min.)		1.5	1.5	1.5	2.5	2.5	2.5	
RETENTION TIME (min.)		30	30	30	150	150	150	
TEST pH		9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	COMPARISON CRITERIA
Explosives								
135TNB	*0.449*	[5 C]	[190 C]	LT 0.449	[5.5 C]	[37.1 C]	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	[19.5 C]	LT 0.611	LT 3.1	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.064	LT 0.064	LT 0.32	LT 0.064	LT 0.064	0.18
HMX	*1.21*	34 C	LT 6	LT 1.21	32 C	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2300 C]	LT 1.17	LT 1.17	[2500 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[48000]	[48000]	[48000]	[48000]	[48000]	[44000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 12

FIELD ID		G13I23L	G13U23L	G13E23L	G13I24L	G13U24L	G13E24L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		31-oct-1993	31-oct-1993	31-oct-1993	31-oct-1993	31-oct-1993	31-oct-1993	
SAMPLE TIME		00:05	00:05	00:05	02:40	02:40	02:40	
OZONE (mg/L/min.)		2.5	2.5	2.5	2.5	2.5	2.5	
RETENTION TIME (min.)		90	90	90	30	30	30	
TEST pH		9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	UGL	UGL	CRITERIA
Explosives								
135TNB	*0.449*	[5.5 C]	[96 C]	LT 0.449	[4.4 C]	[210 C]	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	1.03 C	LT 0.611	LT 3.1	[13.3 C]	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.064	LT 0.064	LT 0.32	LT 0.064	LT 0.064	0.18
HMX	*1.21*	30 C	LT 1.21	LT 1.21	30 C	LT 1.21	LT 1.21	1750
RDX	*1.17*	[1400 C]	LT 1.17	LT 1.17	[1300 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[48000]	[48000]	[44000]	[44000]	[48000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94   Page # : 13

	CRLs							COMPARISON CRITERIA
FIELD ID		G13I25L	G13U25L	G13E25L	G13I26L	G13U26L	G13E26L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		31-oct-1993	31-oct-1993	31-oct-1993	01-nov-1993	01-nov-1993	01-nov-1993	
SAMPLE TIME		06:00	06:00	06:00	14:00	14:00	14:00	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		150	150	150	90	90	90	
TEST pH		9	9	9	9	9	9	
H2O2 (mg/L)		0	0	0	0	0	0	
UNITS		UGL	UGL	UGL	UGL	UGL	UGL	
Explosives								
135TNB	*0.449*	[5.5 C]	[45.8 C]	LT 0.449	[2.7 C]	[91 C]	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	LT 0.611	LT 0.611	LT 3.1	1.19 C	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.064	LT 0.064	LT 0.32	LT 0.064	LT 0.064	0.18
HMX	*1.21*	28 C	LT 1.21	LT 1.21	32 C	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2000 C]	LT 1.17	LT 1.17	[2100 C]	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[48000]	[48000]	[44000]	[48000]	[60000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 14

	CRLs	G13I27L	G13I27LD	G13U27L	G13E27L	G13I28L	G13U28L	G13E28L	COMPARISON CRITERIA
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		01-nov-1993	01-nov-1993	01-nov-1993	01-nov-1993	01-nov-1993	01-nov-1993	01-nov-1993	
SAMPLE TIME		17:15	17:15	17:15	17:15	20:55	20:55	20:55	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		30	30	30	30	150 wo/UV	150 wo/UV	150 wo/UV	
TEST pH		9	9	9	9	7	7	7	
H2O2 (mg/L)		0	0	0	0	1.2	1.2	1.2	
UNITS		UGL	UGL	UGL	UGL	UGL	UGL	UGL	
Explosives									
135TNB	*0.449*	[3 C]	[2.3 C]	[230 C]	LT 0.449	[3.6 C]	[3.66 C]	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	LT 3.1	[7.05 C]	LT 0.611	LT 3.1	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.32	LT 0.064	LT 0.064	LT 0.32	LT 0.064	LT 0.064	0.18
HMX	*1.21*	28 C	28 C	LT 1.21	LT 1.21	LT 24	2.43 C	LT 1.21	1750
RDX	*1.17*	[2100 C]	[2900 C]	LT 1.17	LT 1.17	[1900 C]	[33.9 C]	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics									
NITRATE/NITRITE	*10*	[48000]	[48000]	[48000]	[48000]	[48000]	[52000]	[44000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94   Page # : 15

	CRLs							COMPARISON CRITERIA
FIELD ID		G13I29L	G13U29L	G13I29L	G13I30L	G13U30L	G13E30L	
SITE ID		4-13	4-13	4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	CGW	CGW	
SAMPLE DATE		02-nov-1993	02-nov-1993	02-nov-1993	02-nov-1993	02-nov-1993	02-nov-1993	
SAMPLE TIME		00:20	00:20	00:20	03:50	03:50	03:50	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		90 wo/UV	90 wo/UV	90 wo/UV	30 wo/UV	30 wo/UV	30 wo/UV	
TEST pH		7	7	7	7	7	7	
H2O2 (mg/L)		1.2	1.2	1.2	1.2	1.2	1.2	
UNITS		UGL	UGL	UGL	UGL	UGL	UGL	
Explosives								
135TNB	*0.449*	[3.5 C]	[3.22 C]	LT 0.449	LT 2.2	[6.48 C]	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	LT 0.611	LT 0.611	LT 3.1	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.064	LT 0.064	LT 0.32	LT 0.064	LT 0.064	0.18
HMX	*1.21*	18 C	4.41 C	LT 1.21	21 C	13 C	LT 1.21	1750
RDX	*1.17*	[2000 C]	[74.9 C]	LT 1.17	[2500 C]	[340 C]	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 7.8	LT 1.56	LT 1.56	52.5
Other Inorganics								
NITRATE/NITRITE	*10*	[44000]	[52000]	[48000]	[48000]	[52000]	[48000]	10000

Table 3-2 (cont'd)

Site 4 Groundwater Data -- 03/15/94 Page # : 16

FIELD ID		G13I31L	G13U31L	G13E31L	G13E31LD	
SITE ID		4-13	4-13	4-13	4-13	
MATRIX		CGW	CGW	CGW	CGW	
SAMPLE DATE		02-nov-1993	02-nov-1993	02-nov-1993	02-nov-1993	
SAMPLE TIME		15:30	15:30	15:30	15:30	
OZONE (mg/L/min.)		3.5	3.5	3.5	3.5	
RETENTION TIME (min.)		150	150	150	150	
TEST pH		7	7	7	7	
H2O2 (mg/L)		0	0	0	0	COMPARISON
UNITS	*CRLs*	UGL	UGL	UGL	UGL	CRITERIA
Explosives						
135TNB	*0.449*	[3.9 C]	[7.96 C]	LT 0.449	LT 0.449	1.75
13DNB	*0.611*	LT 3.1	LT 0.611	LT 0.611	LT 0.611	3.5
24DNT	*0.064*	LT 0.32	LT 0.064	LT 0.064	LT 0.064	0.18
HMX	*1.21*	24 1	LT 1.21	LT 1.21	LT 1.21	1750
RDX	*1.17*	[2000 C]	LT 1.17	LT 1.17	LT 1.17	10
TETRYL	*2.49*	LT 7.8	LT 1.56	LT 1.56	LT 1.56	52.5
Other Inorganics						
NITRATE/NITRITE	*10*	[48000]	[56000]	[48000]	[48000]	10000

GT = Greater Than
LT = Less Than
NA = Not Available

ND = Not Detected
NSA = No Standard Available
NT = Not Tested

[ ] = Detected concentration exceeds comparison criterion
C = Confirmed Result
U = Unconfirmed Result

Field ID	Ozone Dosage (mg/L/min)	Retention Time (min)	pH
G13U10L	1.5	150	5
G13U11L	1.5	90	5
G13U13L	2.5	150	5
G13U14L	2.5	90	5
G13U16L	3.5	150	5
G13U17L	3.5	90	5

Similar to well 4-1, the results indicate that a lower pH of 5 is best to treat the explosives, as well as a retention time of greater than 30 minutes and possibly at least 90 minutes. However, it appears that a lower ozone dosage of 1.5 mg/L/min was sufficient to treat the levels and types of explosives present at well 4-13.

The three tests involving hydrogen peroxide/ozone, and no UV, indicated that this type of treatment is not nearly as effective as UV/ozone. As presented in Table 3-2, the results for these three tests (field IDs G13U28L, G13U29L, and G13U30L) indicated that none of the explosives--not just 1,3,5-TNB--were not well degraded after the hydrogen peroxide/ozone treatment.

Even though most of the UV/ozone treatment conditions did not effectively treat all of the explosives, note that the carbon effectively polished the groundwater such that no detectable concentrations of explosives were discharged to the ground.

3.3 <u>USABILITY OF UV/OZONE TREATMENT SYSTEM</u>

In general, the UV/ozone system was easy to set up and maintain. The system consisted of three main components--UV/ozone reactor, ozone generator, and air preparation system. They were supplied by Ultrox. The remaining components--including external generator/fuel and 6,500- and 4,500-gallon tanks--came from separate sources, and were coordinated by Dames & Moore.

The set up was quick, taking approximately one day. All components were placed on skids, making unloading and setup very easy with the use of a forklift. Setup of the system was facilitated by the Ultrox engineer who knew where to locate all components in a most efficient manner. All fittings were quick connect/disconnect type.

The operation of the Ultrox system was divided among two 12-hour shifts, and included operation of the pumping tests. The daytime shift work for the UV/ozone system was supervised by the Ultrox engineer, while the nighttime shift was supervised by a trained Dames & Moore person. The operation of the system was easy, although certain conditions had to be maintained throughout the treatability tests. Each of the operating parameters--ozone dosages, retention time, and pH--had to be continually monitored and adjusted throughout the shift. Sampling of the effluent from the UV/ozone system was easily performed via a sample tap. The pH was measured before and after treatment by the UV/ozone system, and was found to increase about 0.5 after the system. However, this was not considered to be of concern.

The Ultrox system was essentially maintenance free. One filter on the air compressor needed to be relieved manually and the flowmeter on the influent line to the UV/ozone reactor malfunctioned and needed to be replaced. In addition, the black holding tank for the ozone generator increased in temperature during the day such that it could not generate the higher ozone dosages. However, the tests requiring high ozone dosages were performed during the nighttime shifts when the sun was not present to heat up the tank.

As with the mobilization, the de-mobilization of the system was quick, and took approximately one-half day. No problems were encountered.

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APPENDIX A:

Ultrox Report

ULTROX

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ULTROX DIVISION OF ZIMPRO ENVIRONMENTAL, INCORPORATED

UV/OXIDATION FIELD PILOT STUDY

FOR

DAMES & MOORE, INCORPORATED

AN EVALUATION OF THE ULTROX® UV/OXIDATION TREATMENT OF GROUNDWATER FROM THE UMATILLA DEPOT ACTIVITY HERMISTON, OREGON

Submitted by:
Bill Himebaugh and Paul Nguyen
ULTROX division of Zimpro Environmental, Inc.

February 22, 1994

Revision 1
June, 1995

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1.0 EXECUTIVE SUMMARY

Ultrox division of Zimpro Environmental, Inc. (Ultrox) was contracted by Dames & Moore, Inc. (Dames & Moore) to conduct a field pilot study to evaluate the effectiveness of the advanced oxidation process (AOP) on the destruction of explosives in groundwater.

The field pilot study was conducted in two phases. The first phase was conducted from October 13 to October 21, 1993 and evaluated the treatment of explosives from well 4-1. The second phase was conducted from October 27 to November 3, 1993 and evaluated the treatment of explosives in groundwater from well 4-13. A total of 31 separate test conditions were evaluated for each phase (31 tests from Well 4-1 and 31 tests from Well 4-13). The UV/Oxidation system utilized for this pilot study was the Ultrox® P-650 UV/Oxidation pilot system consisting of a 650 gallon (working capacity) UV treatment tank, a 28 lb/day ozone generator (operating on compressed air), a Decompozon™ residual ozone decomposer, a hydrogen peroxide feed system, and a pH adjustment system (see Figure 1). The treatment variables for the tests included ozone (O_3) dosage, hydrogen peroxide dosage (H_2O_2), UV exposure time (or residence time) and pH. The first 27 oxidation tests for each phase were conducted based upon a 3 x 3 (Table 3) matrix which varied UV exposure time, ozone and pH dosing rate of the groundwater. Hydrogen peroxide was evaluated in the final 3 samples of each test phase and not in the first 27 tests (Test 31 duplicated the conditions of Test 7). Hydrogen peroxide was not evaluated in the first 27 tests because historical data from previous tests conducted by Ultrox, involving the oxidation of explosives, indicates that UV with ozone is more effective in the destruction of explosives than UV with H_2O_2. Tests 28 -30 were conducted with ozone and hydrogen peroxide without UV.

Prior to the start of the pilot study, a sample was collected from Well 4-1 by Dames & Moore and shipped to Ultrox for bench scale evaluation. The purpose of the bench scale test was to determine if the ozone and UV dosages in the test plan were sufficient to provide the required data to optimize treatment conditions during the pilot study. The laboratory tests results indicated sufficient reduction in total organic

carbon to postulate that the test plan conditions would suffice. In addition to oxidation tests, the untreated sample was analyzed for parameters which may affect the oxidation process. The results are provided in Table 7.

The first phase of the study was conducted on groundwater from Well 4-1. This groundwater was characterized by relatively high concentrations of 2,4,6-TNT (average of 2,773 μg/l), RDX (average of 2,765 μg/l) and HMX (average of 1,253 μg/l). Although present in lower concentrations, the most persistent compound during the test was 1,3,5-Trinitrobenzene (1,3,5-TNB). Results indicate that 1,3,5-TNB was actually increased during the initial oxidation before being oxidized to below the treatment objective concentration of 0.6 μg/l. Treatment objectives for all compounds were achieved with 90 minutes of UV exposure and 316 mg/l of ozone. Prior to treatment, the groundwater pH was reduced to 5 by addition of sulfuric acid.

The second phase of the study was conducted on groundwater from Well 4-13. This groundwater contained significantly lower concentrations of all compounds except RDX (average concentration of 2,080 μg/l). However, during the oxidation process, increases in 1,3,5-TNB were detected. It is not known what precursors contributed to the increases in 1,3,5-TNB since 2,4,6-TNT (a known precursor of 1,3,5-TNT) was not detected in the untreated groundwater. Treatment objectives were achieved for all detected explosive compounds in five of the oxidation tests conducted on Well 4-13. Each of these tests were conducted with the groundwater pH adjusted to 5 by addition of sulfuric acid. By applying 135 mg/l of ozone during 90.3 minutes of UV exposure (pH of groundwater = 5), 1,3,5-TNB was reduced to 0.76 μg/l. Since this is 0.16 μg/l lower than treatment objective of 0.6 μg/l and the full scale system design allows for an additional 68 lbs/day of ozone, the treatment objectives can be achieved with a full scale system modeled after the treatment conditions from Test 11.

2.0 TECHNOLOGY DESCRIPTION

The Ultrox® technology is an enhanced or advanced oxidation process (AOP) which utilizes UV light, H_2O_2, and/or O_3. H_2O_2 and O_3 vary in their effectiveness depending on the compounds targeted. Ultraviolet light, when combined with H_2O_2 and/or O_3, produces a highly oxidative environment significantly more destructive than that typically created with O_3 or H_2O_2 by themselves or in combination.

UV light significantly enhances ozone or H_2O_2 reactivity by:

i) Transformation of O_3 and H_2O_2 to highly reactive hydroxyl (OH) radicals;

ii) Excitation of the target organic solute to a higher energy level; and

iii) Cleavage of chemical bonds to destroy the target contaminants.

Table 1 illustrates the relative oxidant strength of hydroxyl radical $(OH)^{\circ}$, O_3, H_2O_2 and $C1_2$. Hydroxyl radicals can be formed from UV with O_3, UV with H_2O_2, UV with O_3 and H_2O_2 or O_3 with H_2O_2.

Ultrox® UV/Oxidation treatment systems typically consist of a UV treatment tank, an ozone generator, an air preparation system, a hydrogen peroxide feed system and an off gas treatment system. The UV treatment tank is a gravity vessel constructed of 316L stainless steel and is baffled to provide a serpentine and sinusoidal pathway for the groundwater as it flows through the treatment tank. This flow provides optimized exposure to the UV and oxidants. Ozone is produced on site by from compressed, filtered and dried air. The ozone flows into a manifold on the UV treatment tank which distributes the ozone into the groundwater through spargers or diffusers which are located in the bottom of the treatment tank. Any residual ozone is destroyed by an Ultrox® Decompozon™ destruction unit. The Decompozon™ employs a proprietary, nickel based catalyst. Hydrogen peroxide is applied directly into the UV treatment tank influent line by a chemical metering pump.

When treating volatile compounds, it is not unusual for a small percentage of volatile compounds to strip when ozone is sparged through the UV reactor. Generally, the volume stripped is quite low due to the reactions occurring in the water phase and

the low air-to-water ratio employed. Any volatile organic compounds (VOCs) in the gas phase are destroyed in an off gas control device (D-TOX). Residual ozone in the off gas is converted to oxygen in a catalytic ozone destruct unit (DECOMPOZON™). These units have been tested by the Environmental Protection Agency, which concluded that no VOCs or ozone were detected to be emitting from the DECOMPOZON™/D-TOX unit (see EPA SITE Report No.EPA/540/589/012).

TABLE 1 - Relative Oxidant Strengths

Relative Oxidation Potential (C12 = 1.0)	Species	Oxidation Potential (Volts)
2.23	fluorine	3.03
2.06	hydroxyl radical	2.80
1.78	atomic oxygen (single)	2.42
1.52	ozone	2.07
1.31	hydrogen peroxide	1.78
1.25	perhydroxyl radical	1.70
1.24	permanganate	1.68
1.15	chlorine dioxide	1.57
1.07	hypoiodous acid	1.45
1.00	chlorine	1.36
0.80	bromine	1.09
0.39	iodine	0.54

3.0 TEST OBJECTIVES

3.1 The objectives of the field pilot study were as follows:

- To obtain sufficient data to identify the most effective and cost efficient ozone dosing rate, UV exposure time and pH combination that would destroy the target contaminants to below the treatment objective concentrations specified for each compound (see Table 2).

- To identify appropriate dosages of ozone and UV exposure time or retention time required to achieve those treatment objectives most efficiently.

- To obtain data required to develop capital, operating and maintenance costs of a full scale system capable of achieving the treatment objectives at a flow rate of 100 gpm.

TABLE 2 - Treatment Objectives

TARGET COMPOUND	OBJECTIVE CONCENTRATION (μg/l)
RDX	2
HMX	1.65
2,4,6-Trinitrotoluene (2,4,6-TNT)	2
2,4-Dinitrotoluene (2,4-DNT)	0.60
2,6-Dinitrotoluene (2,6-DNT)	1.15
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.60
1,3-Dinitrobenzene (1,3-DNB)	0.50
Nitrobenzene	1.07
Tetryl	0.55

4.0 EQUIPMENT AND MATERIALS

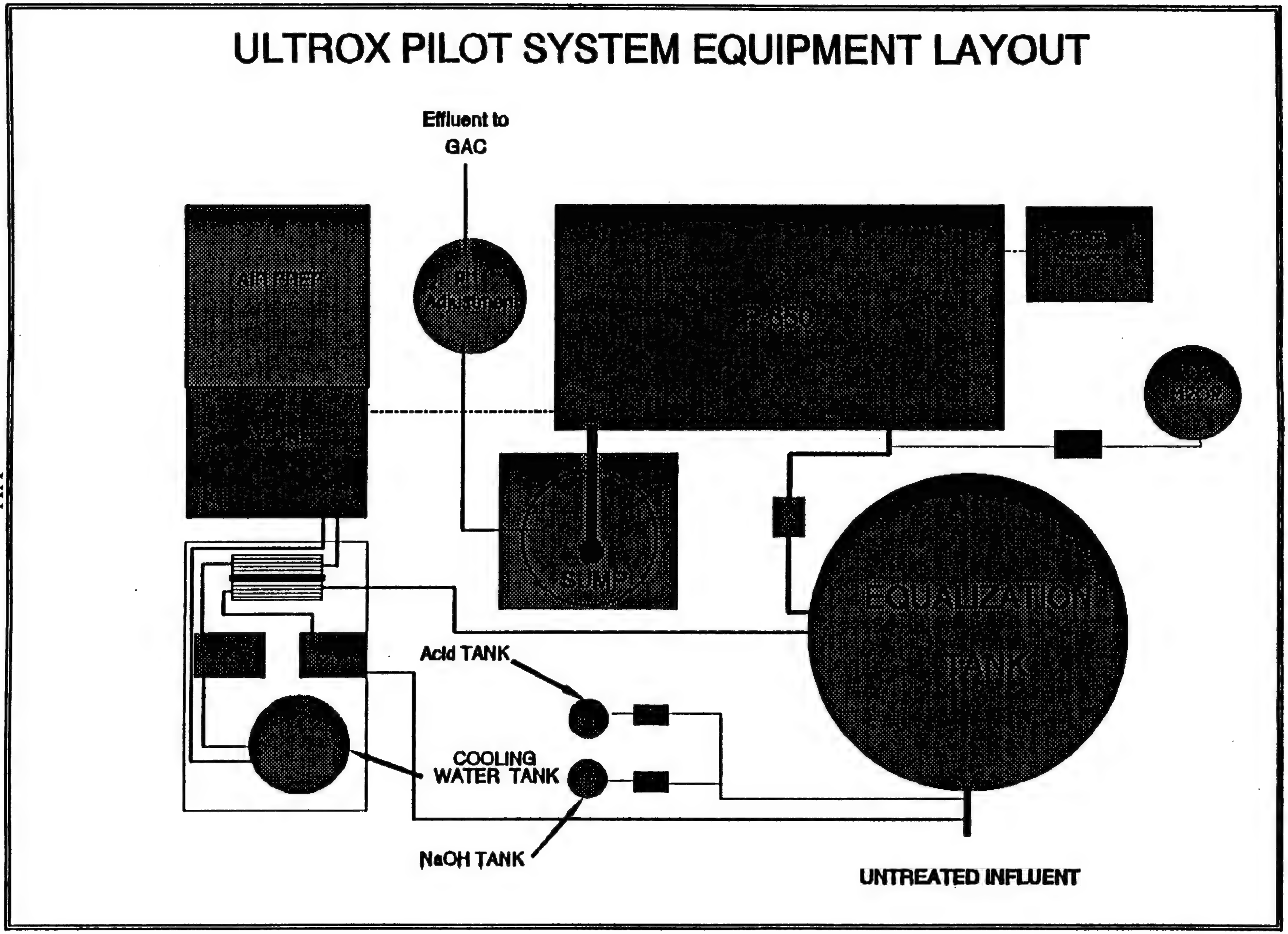
The pilot plant project included the following equipment and materials:

- Ultrox® P-650 UV Treatment Tank
- Air Preparation System consisting of:
  - Compressor
  - Air Filter
  - Air Dryer
- 28 lb/day PCI Ozone Generator
- Decompozon™ Residual Ozone Destruction Unit
- Hydrogen Peroxide Feed Assembly
- 6,500 gallon Equalization Tank
- 400 gallon sump and sump pump
- 4,000 gallon effluent pH adjustment tank
- pH adjustment equipment consisting of:
  - Caustic chemical metering pump
  - Acid chemical metering pump
  - Sodium hydroxide solution
  - Sulfuric acid solution

4.1 Ultrox® P-650 UV Treatment Tank

The Ultrox® P-650 UV Treatment Tank is constructed of 316L stainless steel and has a working capacity of 650 gallons. The P-650 is a gravity tank designed with six internal baffles which divide the inside of the tank and provide a serpentine and sinusoidal flow of water through the tank. The P-650 contains 72 Ultrox® UV lamps (12 lamps per baffled area), ozone diffusers and six sample ports. Figure 1 provides a sketch of the Ultrox® P-650 UV/oxidation system.

Figure 1


ULTROX PILOT SYSTEM EQUIPMENT LAYOUT
Effluent to GAC
SUMP
EQUALIZATION TANK
Acid TANK
COOLING WATER TANK
NaOH TANK
UNTREATED INFLUENT

4.2 Air Preparation

The Air Preparation System employed at Umatilla consisted of a rotary screw type air compressor, air filter unit (to remove compressor oils and particulates), and a regenerative desiccant dryer (reduces dewpoint in the air to less than -70°F).

4.3 Ozone Generator

The ozone generator employed during the field pilot test was a 28 lb/day, fixed voltage, variable frequency inverter generator. This system produces ozone from the air treated in the Air Preparation System. The resulting ozone (concentration = 2% in air) flows to the P-650 UV treatment tank ozone manifold for distribution throughout the UV treatment tank.

4.4 Decompozon™ Residual Ozone Destruction Unit

The Decompozon™ Unit is a catalytic ozone destruction unit which reduces the residual ozone from the P-650 UV treatment tank to below 0.1 ppm by weight.

4.5 Hydrogen Peroxide Feed Assembly

The Hydrogen Peroxide Feed Assembly consists of a chemical metering pump, pump stand and calibration tube. The metering pump injects the hydrogen peroxide into the influent line of the P-650 UV Treatment Tank.

4.6 6500 Gallon Equalization Tank

A 6500 gallon polyethylene tank was provided to collect the water from the well pumps prior to oxidation. Water from the equalization tank was pumped at the prescribed test flow rates into the UV treatment tank.

4.7 Effluent Sump

A 400 gallon polyethylene tank was provided to collect the treated groundwater from the P-650 UV Treatment Tank. The groundwater was pumped from the sump to the pH adjustment tank by a float actuated sump

pump located in the bottom of the sump. Caustic and acid were added to the groundwater in the sump as required to neutralize the pH.

4.8 4000 Gallon Effluent pH Adjustment Tank

A 4000 gallon polyethylene tank was provided downstream of the sump to allow for adequate retention time for pH adjustment from the sump.

4.9 pH Adjustment Equipment

The pH adjustment equipment consisted of two chemical metering pumps (one for sulfuric acid and one for sodium hydroxide) and reservoirs containing the acid and caustic. These pumps served to adjust the groundwater pH either upstream prior to UV/Oxidation or downstream to neutralize the pH.

5.0 OXIDATION TEST PROCEDURES

5.1 Laboratory Test

Prior to conducting the field pilot test, two laboratory bench scale tests were conducted on a groundwater sample from Well 4-1. Each test was conducted with UV and ozone at the existing pH of 7. The first bench scale test was conducted for a period of 150 minutes with an ozone dosing rate of 3.5 mg/l/min. Samples were collected after 30, 90, and 150 minutes of UV exposure and analyzed for TOC. Results indicated that the TOC was reduced from 8.7 to 1.8 by the end of the test (Table 3). This is below the TOC concentration of the distilled water blank (1.9 mg/l). This reduction in TOC indicates that UV with ozone significantly reduces the explosives concentration within 150 minutes and confirms our upper limit for field pilot treatment. The second bench scale test was conducted for 150 minutes with an ozone dosing rate of 1.5 mg/l/min. Samples were collected after 30, 90, and 150 minutes of UV exposure and analyzed for TOC. Results indicate that TOC was reduced from 8.7 to 2.1 after 150 minutes of UV exposure. This TOC reduction indicates that even at lower ozone dosing rates it is likely that the explosives concentration was significantly reduced. Based upon this information, the test plan for the pilot study (Table 4) was developed using 30 minutes of UV treatment with 1.5 mg/l/min of ozone as the low level of treatment and 150 minutes of UV treatment with 3.5 mg/l/min of ozone as the high level of treatment. Historical data indicates that correlations exist between the reduction in 1,3,5-TNB and TOC. Since 1,3,5-TNB is the most persistent of the target compounds, it was concluded that treatment objectives could be achieved with the high level treatment conditions, and treatment objectives would not be achieved with the low level treatment conditions. Therefore, the optimum treatment conditions were somewhere between the high and low treatment level conditions and could be determined by results of our test plan.

TABLE 3 - BENCH SCALE TOC REDUCTION

Time (min)	Test 1 Ozone = 3.5 mg/l/min	Test 2 Ozone = 1.5 mg/l/min	Untreated Distilled Water
0	8.7	8.7	1.9
30	3.2	4.8	1.9
90	2.4	2.7	1.9
150	1.8	2.1	1.9

Note: All TOC results are expressed in mg/L

5.2 Preparation

The Ultrox field engineer (Paul Nguyen) arrived at the Umatilla Army Depot Activity site on September 27, 1993, to prepare for arrival of equipment, assist in site preparation and obtain badges and vehicle permits. The UV/Oxidation equipment arrived on site on September 30, 1993. The Ultrox field engineer assembled the equipment conducted a system check. System was found to be in working condition. The UV/Oxidation was inspected for damage and proper installation. No damage was noted.

5.3 Testing

Phase 1 testing (Well 4-1) commenced on October 4, 1993 and was completed with the final sample collection of Test 31 on October 21, 1993. Phase 2 (Well 4-13) began on October 27, 1993 and was completed after final sample collection of Test 31 on November 2, 1993. Table 4 provides the test plan followed during each of the two phases of testing. The concentration of ozone diffused into the UV treatment tank during the testing was 2% by weight percentage. The ozone for each test was diffused into the UV treatment tank at a continuous rate.

Ultrox field engineer's field notes and daily log are provided in the Appendix.

TABLE 4 - TREATMENT CONDITIONS

Test No.	Time Well 4-1	Time Well 4-13	Flow	Retention Time	Ozone (mg/l/min)	H2O2	pH	Samples
1	10:45 - 14:54	11:45 - 14:45	4.3	151.16	1.5	-	7	1
2	15:15 - 18:15	15:05 - 18:05	7.2	90.28	1.5	-	7	3
3	18:35 - 21:35	18:15 - 21:15	21.6	30.09	1.5	-	7	3
4	22:00 - 01:00	21:30 - 00:30	4.3	151.16	2.5	-	7	3
5	01:35 - 04:35	01:00 - 04:00	7.2	90.28	2.5	-	7	3
6	04:55 - 07:55	04:15 - 07:15	21.6	30.09	2.5	-	7	3
7	08:15 - 11:15	07:30 - 10:30	4.3	151.16	3.5	-	7	3
8	01:30 - 04:30	10:45 - 13:45	7.2	90.28	3.5	-	7	3
9	05:00 - 08:00	13:55 - 16:55	21.6	30.09	3.5	-	7	3
10	11:00 - 14:00	19:15 - 22:15	4.3	151.16	1.5	-	5	3
11	14:30 - 17:30	22:45 - 01:45	7.2	90.28	1.5	-	5	3
12	17:45 - 20:45	02:10 - 05:10	21.6	30.09	1.5	-	5	3
13	21:00 - 24:00	05:30 - 08:30	4.3	151.16	2.5	-	5	3
14	01:05 - 04:05	09:00 - 12:00	7.2	90.28	2.5	-	5	3
15	04:35 - 06:35	12:20 - 15:20	21.6	30.09	2.5	-	5	3
16	07:05 - 10:05	15:40 - 18:40	4.3	151.16	3.5	-	5	3
17	10:20 - 13:20	19:00 - 22:00	7.2	90.28	3.5	-	5	3
18	13:50 - 15:50	22:10 - 01:10	21.6	30.09	3.5	-	5	3
19	17:30 - 20:30	08:00 - 11:00	4.3	151.16	1.5	-	9	3
20	21:00 - 24:00	11:20 - 14:20	7.2	90.28	1.5	-	9	3
21	00:50 - 03:50	14:35 - 17:35	21.6	30.09	1.5	-	9	3
22	04:30 - 07:30	17:45 - 20:45	4.3	151.16	2.5	-	9	3
23	08:05 - 11:05	21:05 - 00:05	7.2	90.28	2.5	-	9	3
24	11:35 - 14:35	00:40 - 02:40*	21.6	30.09	2.5	-	9	3
25	15:05 - 18:05	03:00 - 06:00	4.3	151.16	3.5	-	9	3
26	18:25 - 21:25	11:00 - 14:00	7.2	90.28	3.5	-	9	3
27	21:50 - 00:55	14:15 - 17:15	21.6	30.09	3.5	-	9	3
28	16:00 - 19:00	17:55 - 20:55	4.3	151.16	3.5	1.2	7	3
29	19:15 - 22:15	21:20 - 00:20	7.2	90.28	3.5	1.2	7	3
30	22:45 - 01:45	00:50 - 03:50	21.6	30.09	3.5	1.2	7	3

* Daylight Savings Time Began

5.4 Sample Analyses.

Samples were collected by Dames & Moore personnel and the Ultrox field engineer during the pilot program. Influent samples were collected from a valved sample port located on the influent line of the UV treatment tank. Effluent samples were collected from a valved sample port located on the effluent gooseneck weir. The collected samples were sent by Dames & Moore to Environmental Science & Engineering Laboratory (ESE) in Gainesville, Florida, for analysis. Results are provided in Tables 5 and 6.

6.0 RESULTS AND CONCLUSIONS

Analytical results (Tables 5 and 6) from ESE Laboratory indicate that the groundwater from Well 4-1 and Well 4-13 were quite dissimilar. Well 4-1 can be characterized as having significantly higher concentrations than Well 4-13 of all targeted compounds except RDX and Tetryl.

6.1 Laboratory Bench Scale Test

Prior to the field pilot testing, a sample was collected from Well 4-1 by Dames & Moore and sent to Ultrox for laboratory bench scale evaluation. The purpose of the bench scale test was to determine the oxidant dosages estimated to meet reductions in total organic carbon (TOC) and apply that data in the development of a test plan for the field pilot study. The untreated sample was analyzed for parameters which can affect the oxidation process (Table 7). These results indicate that the groundwater contained low concentrations of iron and manganese (removal not required), low suspended solids (<4 mg/l), low turbidity (0.3 NTUs), low chlorides (29 mg/l), moderately high hardness and dissolved solids (314 and 384 mg/l respectively). The total organic carbon (TOC) was 11 mg/l and the chemical oxygen demand (COD) was 27 mg/l. The pH was neutral (7). The untreated sample was subjected to two bench scale oxidation tests. The first test was conducted with an ozone dosing rate of 3.5 mg/l/min. Samples were collected after 30, 90 and 150 minutes of UV treatment (as in all tests involving UV and ozone, ozone and UV were applied simultaneously and continuously). Total organic carbon was reduced from 7.8 mg/l to 1.8 mg/l after 150 minutes of treatment. The second tests was conducted with an ozone dosing rate of 1.5 mg/l/min. Samples were collected after 30, 90 and 150 minutes of UV treatment. At this lower dosing rate, the TOC was reduced from 8.9 to 2.1. Based on the reductions in TOC achieved during the bench scale tests, it was postulated that the treatment objectives for all explosives would be achieved by applying an ozone dosing rate between 1.5 and 3.5 mg/l/min during a UV irradiation period of between 30 and 150 minutes.

6.2 Well 4-1 Results

The Well 4-1 groundwater contained relatively high concentrations of RDX (1,210-3,420 μg/l) and 2,4,6-TNT (959-3310 μg/l) with moderate levels of HMX (299-2,310 μg/l), 2,4-DNT (127-335 μg/l), and 1,3,5-TNB (120-356 μg/l). Tetryl was detected in 5 influent samples and concentrations ranged from 1.82 to 9.95 μg/l.

6.2.1 RDX Destruction

The average concentration of RDX detected in the untreated groundwater was 2,765.5 μg/l and ranged from 1,210 to 3,520 μg/l. The results of the oxidation tests indicate that RDX was reduced to below the treatment object concentration (<2 μg/l) with the lowest ozone dosing rate (1.5 mg/l/min) after 90 minutes of UV exposure at a neutral pH (Test 2). RDX was also reduced to below treatment objective concentration within 30 minutes at the higher ozone dosing rate of 3.5 mg/l/min (Test 18). It is important to note, that the ozone dosing rate is not the same as the total ozone dosage. Results from Test 2 indicate that the total ozone dosage was 135.42 mg/l (1.5 mg/l/min x 90.28 minutes = 135.42 mg/l). This is higher than the 105.2 mg/l (3.5 mg/l/min x 30.09 minutes = 105.32 mg/l) total ozone dosage applied in Test 18 due to the longer UV exposure (retention) time. A comparison of Tests 9, 18 and 27 indicates that the lower pH of 5 resulted in better RDX reduction than tests where the pH was 7 or 9.

6.2.2 Tetryl Destruction

With the exceptions of Tests 2, 3, 4, 6 and 7, Tetryl was not detected in the untreated samples. When detected, the concentrations ranged from 1.82 to 9.5 μg/l. Tetryl was reduced to below the detection limit of 1.56 for all tests except 12 where the detected concentration was 2.25 μg/l. Since no Tetryl was detected in the untreated sample, and

it is not considered a byproduct of the other species detected, the Tetryl result from Test 12 is considered an anomaly.

6.2.3 Destruction of 2,4-Dinitrotoluene

Results indicate that the average 2,4-DNT concentration in the untreated groundwater was 284.2 μg/l. Concentrations ranged between 127 and 335 μg/l. The treatment objective concentration of 0.6 μg/l was achieved for all tests where UV exposure time (or retention time) was 90 minutes or greater. The treatment objective for 2,4-DNT was also achieved within 30 minutes of treatment with an ozone dosing rate of 3.5 mg/l/min.. However, the most efficient UV/Oxidation of 2,4-DNT occurred in Test 15 where the concentration was reduced to below 0.33 μg/l at the ozone dosing rate of 2.5 mg/l/min during 30 minutes of UV exposure. This reduction was only achieved at pH 5 and not at 7 or 9. Results from tests 28, 29 and 30 indicate that a combination of ozone and hydrogen peroxide without UV could also reduce the 2,4-DNT to below 0.6 μg/l with a dosing rate of 3.5 mg/l/min of ozone and 1.2 mg/l/min of hydrogen peroxide for a period between 30 and 90 minutes of retention time.

6.2.4 Destruction of HMX

The average HMX concentration detected in the untreated Well 4-1 groundwater was 1,252.6 μg/l. The concentration ranged between 270 and 2,310 μg/l. The treatment objective for HMX (1.65 μg/l) was achieved in all tests which involved UV/Oxidation for 90.3 minutes or greater. Where the ozone dosing rate of 3.5 mg/l/min was applied, treatment objectives were achieved within 30 minutes of UV exposure. While tests involving ozone and hydrogen peroxide without UV resulted in decreases in HMX, this approach was not effective in reducing the HMX below 468 μg/l.

6.2.5 Destruction of 2,4,6-Trinitrotoluene

The average 2,4,6-DNT concentration detected in the untreated groundwater was 2,773.2 μg/l. The concentration ranged between 959 and 3,310 μg/l. The treatment objective for 2,4,6-TNT (2 μg/l) was achieved for all tests where UV/Oxidation treatment was conducted for 90.3 minutes or greater. Treatment objectives were achieved after 30 minutes of treatment during Test 18 where the ozone dosing rate was 3.5 mg/l/min and the influent pH was 5. These objectives were not achieved at that dosing rate when the pH was 7 or 9. Tests involving ozone and hydrogen peroxide without UV were not effective in reducing the 2,4,6-TNT below 338 μg/l.

6.2.6 Destruction of 1,3,5-Trinitrobenzene

The average concentration of 1,3,5-TNB detected in the untreated groundwater was 164.3 μg/l. The concentration ranged from 120 to 356 μg/l. The treatment objective concentration for 1,3,5-TNB (0.6 μg/l) was achieved in two oxidation tests (Tests 16 and 17). These tests were conducted with the groundwater pH adjusted to 5 and an ozone dosing rate of 3.5 mg/l/min during a minimum UV exposure time of 90.3 minutes. Based upon the data, the optimum treatment conditions required for achieving the treatment objectives for 1,3,5-TNB include 3.5 mg/l/min for 90.3 minutes with the groundwater pH adjusted to 5. Because 1,3,5-TNB was the most persistent compound treated, these treatment conditions achieved treatment objectives for all compounds detected. While a nominal reduction in 1,3,5-TNB was detected in Test 28, the other tests conducted with O_3 and H_2O_2 without UV resulted in increased 1,3,5-TNB concentrations.

6.3 Well 4-13 Results

Well 4-13 groundwater contained significantly lower concentrations of all explosive compounds except RDX. The RDX concentration (average of

2,080 μg/l) was comparable to the concentration detected from Well 4-1 (average of 2,765 μg/l).

6.3.1 RDX Destruction

The average concentration of RDX detected in the untreated groundwater was 2,080 μg/l and ranged from 972 to 2,600 μg/l. The analytical results indicate that RDX was reduced to below the treatment object concentration (<2 μg/l) in all UV/Oxidation tests except Test 21. Test 21 was performed with the lowest ozone dosing rate (1.5 mg/l/min) and the shortest UV exposure time (30 minutes) with the groundwater pH at 9. Despite the low ozone dosage and UV exposure associated with Test 21, RDX was reduced to within 0.28 μg/l of the objective concentration. Results from tests 28, 29 and 30 indicate that ozone and hydrogen peroxide without UV was effective in reducing the RDX by 85% to 98%. However, non of the non-UV tests achieved the treatment objective for RDX within 151.2 minutes.

6.3.2 Tetryl Destruction

With the exceptions of Tests 17 and 18, Tetryl was not detected in the untreated samples. The detected concentrations were 1.84 and 1.77 μg/l respectively. Tetryl was not detected above the detection limit of 1.56 for any of the tests.

6.3.3 Destruction of 2,4-Dinitrotoluene

Results indicate that the 2,4-DNT concentration in the untreated groundwater was not detected except in Test 8 (0.192 μg/l). No 2,4-DNT was detected in any of the effluent samples.

6.3.4 Destruction of HMX

The average of the HMX concentrations detected in the untreated groundwater was 30.2 μg/l. The detected concentrations ranged between 17.5 and 61 μg/l. The treatment objective for HMX (1.65 μg/l) was achieved in all tests which involved UV/Oxidation at a pH of 5 or 7. Where the pH of the groundwater was 9, the objective concentration was achieved when 2.5 mg/l/min was applied for 90.3 minutes. However at the higher ozone dosing rate of 3.5, the objective was not achieved within 90.3 minutes with the groundwater pH at 9. Tests involving ozone and hydrogen peroxide without UV were effective in reducing the HMX, but not below 1.65 μg/l.

6.3.5 Destruction of 2,4,6-Trinitrotoluene

No 2,4,6-TNT was detected in the untreated groundwater from Well 4-13. Consequently, no 2,4,6-TNT was detected in any of the treated samples.

6.3.6 Destruction of 1,3,5-Trinitrobenzene

The average concentration of 1,3,5-TNB detected in the untreated groundwater was 3.9 μg/l. The concentration ranged from 1.71 to 5.72 μg/l. The treatment objective concentration for 1,3,5-TNB (0.6 μg/l) was achieved in five oxidation tests (Tests 10, 13, 14, 16 and 17). Each of these tests were conducted with the groundwater pH of 5. The effluent concentration of 1,3,5-TNB was greater than the influent in all tests except the five where the treatment objective was achieved (and Test 11 where the effluent concentration was

0.764 μg/l). The effluent analytical results indicate that 1,3,5-TNB is being produced during UV/Oxidation. This is generally the result of the oxidation of 2,4,6-TNT. However, since this compound was not detected in the untreated sample, the precursor to 1,3,5-TNB is not known.

The most efficient treatment (lowest total ozone dosage and UV exposure time) conditions were from Test 14 which involved an ozone dosing rate of 2.5 mg/l/min during a minimum UV exposure time of 90.3 minutes. However, because the 30 minute sample (having a total ozone dosage of 105.4 mg/l and UV exposure time of 30.1 minutes) resulted in a 1,3,5-TNB concentration of only 4.91 μg/l, it is probable that the optimum conditions for Well 4-13 will be less than 90.3 minutes and greater than 30.1 minutes of UV exposure with an ozone dosing rate between 2.5 and 3.5 mg/l/min.

Because 1,3,5-TNB was the most persistent compound treated, these treatment conditions achieved treatment objectives for all compounds detected in Well 4-13.

7.0 CONCLUSIONS

Analytical results from Well 4-1 tests indicate that the Ultrox® UV/Oxidation system was capable of reducing all explosives detected in the groundwater to below their respective treatment objective concentrations. The pH of the groundwater had a significant affect on the oxidation process. A pH of 5 provided better reductions in all compounds and was required to meet the treatment objectives for 1,3,5-TNB (the most persistent compound detected). To achieve the treatment objectives for all compounds a cumulative ozone dosage of 316 mg/l is required with 90 minutes of UV irradiation of the groundwater after pH has been adjusted to 5 by addition of sulfuric acid.

Analytical results indicate that the Ultrox® UV/Oxidation system was again effective in reducing all explosives detected in the groundwater from Well 4-13 to below their respective treatment objective concentrations. Although the treatment objective for 1,3,5-TNB was not achieved during Test 11, the full scale system provides adequate reserve ozone production capacity to further reduce the 1,3,5-TNB to below 0.6 μg/l. Based upon a flow rate of 100 gpm and an ozone dosage of 135 mg/l, the full scale system ozone generator capacity required is 162.2 lbs/day. Since Ultrox's ozone generators are produced with production capacities of either 150 lbs/day or 230 lbs/day, the 230 lb/day generator was selected for the full scale system. Since this generator provides an additional capacity of 67.8 lbs/day, more than enough capacity exists to reduce the 1,3,5-TNB concentration an additional 0.164 μg/l. As in the treatment of Well 4-1 groundwater, the pH must be reduced to 5 by addition of sulfuric acid.

Based upon the results of this pilot study and others involving treatment of explosives, the higher the concentration of explosives and the higher the flow rate, the better the economics associated with UV/oxidation.

8.0 COMMERCIAL

This section provides estimated prices in U.S. dollars for the supply of Ultrox equipment and services as described below. These price estimates are based upon F.O.B. point of manufacture. Price estimates do not include federal; state, provincial, regional or municipal taxes. Duties, permits, costs of obtaining permits, bonds and interest or penalties are not included.

8.1 Well 4-1 System

The equipment and prices described under this section are based upon the results of Test 17 of the Well 4-1 test program. This system is capable of meeting the treatment objectives for all detected explosives at a flow rate of 100 gpm. These estimates do not include costs associated with addition of sulfuric acid which is required to reduce the pH from neutral to 5.

8.1.1 Equipment

8.1.1.1 UV Treatment Tank.

Two Ultrox® F-3900 UV treatment tanks.

One Ultrox® F-1300 UV treatment tank.

8.1.1.2 Ozone Generator

One 400 lb/day Ozone generator.

8.1.1.3 Air Preparation System

- Compressor
- Air Filter
- Air Dryer

8.1.1.4 Residual Ozone Destruction System

One Decompozon™ catalytic ozone destruction unit.

8.1.2 Assumptions.

Flow rate = 100 GPM

Cost per KWH = \$0.06

pH = 5

UV retention time = 91 minutes

Ozone injection rate = 3.5 mg/l/minute

Total accumulated ozone dosage = 333 mg/l

8.1.3 Costs

8.1.3.1 Capital Costs

Capital costs for equipment as described in Section 8.1 is estimated to be \$900,000.

8.1.3.2 Operating and Maintenance Costs

Operating Costs:

O_3 ELECTRICITY: \$1.83/1000 GAL

UV ELECTRICITY: \$0.66/1000 GAL

TOTAL OPERATING COSTS .... \$2.49/1000 GAL

Maintenance Costs:

LAMP REPLACEMENT AMORTIZED ON A DAILY BASIS

COST .... \$1.15/1000 GAL

<u>TOTAL O&M COSTS</u> = \$3.64/1000 GAL

8.2 Well 4-13 System

The equipment and prices described under this section are based upon the results of Test 11 of the Well 4-13 test program. This system is capable of meeting the treatment objectives for all detected explosives at a flow rate of 100 gpm. These estimates do not include costs associated with addition of sulfuric acid which is required to reduce the pH from neutral to 5.

8.2.1 Equipment

8.2.1.1 UV Treatment Tank.

Two Ultrox® F-3900 UV treatment tanks.

One Ultrox® F-1300 UV treatment tank.

8.2.1.2 Ozone Generator

One 230 lb/day Ozone generator.

8.2.1.3 Air Preparation System

- Compressor
- Air Filter
- Air Dryer

8.2.1.4 Residual Ozone Destruction System

One Decompozon™ catalytic ozone destruction unit.

8.2.2 Assumptions.

Flow rate = 100 GPM

Cost per KWH = $0.06

pH = 5

UV retention time = 90 minutes

Ozone injection rate = 1.5 mg/l/minute

Total accumulated ozone dosage = 135.5 mg/l

8.2.3 Costs

8.2.3.1 Capital Costs

Capital costs for equipment as described in Section 8.1 is estimated to be $770,000.

8.2.3.2 Operating and Maintenance Costs

Operating Costs:

O_3 ELECTRICITY:	$0.75/1000 GAL
UV ELECTRICITY:	$0.66/1000 GAL

TOTAL OPERATING COSTS .... $1.41/1000 GAL

Maintenance Costs:

LAMP REPLACEMENT AMORTIZED ON A DAILY BASIS

COST .... $1.14/1000 GAL

TOTAL O&M COSTS = $2.55/1000 GAL

APPENDIX

Laboratory Data

Process Flow Diagram

Field Engineer's Daily Log & Notes

LABORATORY DATA

TABLE 5 - FIELD PILOT TEST A

ULTROX P-650 Pilot Program - UN

Phase 1 - We

Run #	Time	Date	Ozone Dose Rate	Ozone Dosage	Flow	Retention Time	pH	H2O2	RDX Influent	RDX Effluen
1	10:45 - 14:54	13-Oct	1.5	226.74	4.3	151.16	7	n/a	2890	1.1
2	15:15 - 18:15	13-Oct	1.5	135.42	7.2	90.28	7	n/a	2920	1.1
3	18:35 - 21:35	13-Oct	1.5	45.14	21.6	30.09	7	n/a	2920	39.
4	22:00 - 01:00	14-Oct	2.5	377.91	4.3	151.16	7	n/a	3020	1.1
5	01:35 - 04:35	14-Oct	2.5	225.69	7.2	90.28	7	n/a	3520	1.1
6	04:55 - 07:55	14-Oct	2.5	75.23	21.6	30.09	7	n/a	2730	10.
7	08:15 - 11:15	14-Oct	3.5	529.07	4.3	151.16	7	n/a	3200	1.1
8	01:30 - 04:30	15-Oct	3.5	315.97	7.2	90.28	7	n/a	3370	1.1
9	05:00 - 08:00	15-Oct	3.5	105.32	21.6	30.09	7	n/a	3420	7.3
10	11:00 - 14:00	15-Oct	1.5	226.74	4.3	151.16	5	n/a	3410	1.1
11	14:30 - 17:30	15-Oct	1.5	135.42	7.2	90.28	5	n/a	3040	1.1
12	17:45 - 20:45	15-Oct	1.5	45.14	21.6	30.09	5	n/a	3240	17.
13	21:00 - 24:00	16-Oct	2.5	377.91	4.3	151.16	5	n/a	3250	1.1
14	01:05 - 04:05	16-Oct	2.5	225.69	7.2	90.28	5	n/a	3230	1.1
15	04:35 - 06:35	16-Oct	2.5	75.23	21.6	30.09	5	n/a	3150	5.2
16	07:05 - 10:05	16-Oct	3.5	529.07	4.3	151.16	5	n/a	2950	1.1
17	10:20 - 13:20	16-Oct	3.5	315.97	7.2	90.28	5	n/a	2870	1.1
18	13:50 - 15:50	16-Oct	3.5	105.32	21.6	30.09	5	n/a	1320	1.2
19	17:30 - 20:30	16-Oct	1.5	226.74	4.3	151.16	9	n/a	1910	1.1
20	21:00 - 24:00	17-Oct	1.5	135.42	7.2	90.28	9	n/a	2030	1.1
21	00:50 - 03:50	17-Oct	1.5	45.14	21.6	30.09	9	n/a	1210	23.
22	04:30 - 07:30	17-Oct	2.5	377.91	4.3	151.16	9	n/a	1870	1.1
23	08:05 - 11:05	17-Oct	2.5	225.69	7.2	90.28	9	n/a	2100	1.1
24	11:35 - 14:35	17-Oct	2.5	75.23	21.6	30.09	9	n/a	2860	10.
25	15:05 - 18:05	17-Oct	3.5	529.07	4.3	151.16	9	n/a	2070	1.1
26	18:25 - 21:25	17-Oct	3.5	315.97	7.2	90.28	9	n/a	1900	1.1
27	21:50 - 00:55	18-Oct	3.5	105.32	21.6	30.09	9	n/a	3120	2.6
28	16:00 - 19:00	18-Oct	3.5	529.07	4.3	151.16	7	1.2	3160	82
29	19:15 - 22:15	18-Oct	3.5	315.97	7.2	90.28	7	1.2	3140	89
30	22:45 - 01:45	19-Oct	3.5	105.32	21.6	30.09	7	1.2	3000	141
–	06:30	21-Oct	3.5	529.07	4.3	151.16	7	n/a	2910	1.1

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TABLE 5 - FIELD PILOT TEST ANALYTICAL RESULTS

ULTROX P-650 Pilot Program - UMATILLA DEPOT ACTIVITY

Phase 1 - Well 4-1

...one ...age	Flow	Retention Time	pH	H2O2	RDX Influent	RDX Effluent	TETRYL Influent	TETRYL Effluent	2,4 DNT Influent	2,4 DNT Effluent	HMX Influent	HMX Effluent
.74	4.3	151.16	7	n/a	2890	1.17	1.56	1.56	313	0.064	270	1.21
.42	7.2	90.28	7	n/a	2920	1.17	1.82	1.56	310	0.064	946	1.21
14	21.6	30.09	7	n/a	2920	39.4	2.12	1.56	322	33	953	786
.91	4.3	151.16	7	n/a	3020	1.17	1.57	1.56	322	0.064	1270	1.21
.69	7.2	90.28	7	n/a	3520	1.17	1.56	1.56	324	0.064	2310	1.21
23	21.6	30.09	7	n/a	2730	10.9	9.95	1.56	304	2.17	1160	219
.07	4.3	151.16	7	n/a	3200	1.17	1.92	1.56	302	0.064	1980	1.21
.97	7.2	90.28	7	n/a	3370	1.17	7.8	1.56	327	0.064	2010	1.21
.32	21.6	30.09	7	n/a	3420	7.31	7.8	1.56	330	0.064	1730	1.21
.74	4.3	151.16	5	n/a	3410	1.17	7.8	1.56	333	0.064	1480	1.21
.42	7.2	90.28	5	n/a	3040	1.17	7.8	1.56	307	0.064	1390	1.21
14	21.6	30.09	5	n/a	3240	17.4	7.8	2.25	331	13.1	1850	1.21
.91	4.3	151.16	5	n/a	3250	1.17	7.8	1.56	329	0.064	1550	1.21
.69	7.2	90.28	5	n/a	3230	1.17	7.8	1.56	321	0.064	1800	1.21
23	21.6	30.09	5	n/a	3150	5.23	7.8	1.56	335	0.331	1460	12.1
.07	4.3	151.16	5	n/a	2950	1.17	7.8	1.56	317	0.064	1520	1.21
.97	7.2	90.28	5	n/a	2870	1.17	7.8	1.56	320	0.064	1090	1.21
.32	21.6	30.09	5	n/a	1320	1.29	7.8	1.56	136	0.064	480	1.21
.74	4.3	151.16	9	n/a	1910	1.17	7.8	1.56	201	0.064	736	1.21
.42	7.2	90.28	9	n/a	2030	1.17	7.8	1.56	215	0.429	843	1.21
14	21.6	30.09	9	n/a	1210	23.5	7.8	1.56	127	59.4	299	30.3
.91	4.3	151.16	9	n/a	1870	1.17	7.8	1.56	191	0.064	674	1.21
.69	7.2	90.28	9	n/a	2100	1.17	7.8	1.56	237	0.064	754	1.21
23	21.6	30.09	9	n/a	2860	10.4	7.8	1.56	316	15.1	1200	30.3
.07	4.3	151.16	9	n/a	2070	1.17	7.8	1.56	216	0.064	863	1.21
.97	7.2	90.28	9	n/a	1900	1.17	7.8	1.56	179	0.064	682	1.21
.32	21.6	30.09	9	n/a	3120	2.62	7.8	1.56	325	0.38	1960	1.21
.07	4.3	151.16	7	1.2	3160	826	7.8	1.56	309	0.318	1560	965
.97	7.2	90.28	7	1.2	3140	890	7.8	1.56	309	0.311	1350	468
.32	21.6	30.09	7	1.2	3000	1410	7.8	1.56	304	0.891	1350	1310
.07	4.3	151.16	7	n/a	2910	1.17	7.8	1.56	297	0.064	1310	24.2

ANALYTICAL RESULTS

MATILLA DEPOT ACTIVITY

ell 4-1

	TETRYL Influent	TETRYL Effluent	2,4-DNT Influent	2,4-DNT Effluent	HMX Influent	HMX Effluent	2,4,6-TNT Influent	2,4,6-TNT Effluent	1,3,5-TNB Influent	1,3,5-TNB Effluent
7	1.56	1.56	313	0.064	270	1.21	3190	0.635	144	142
7	1.82	1.56	310	0.064	946	1.21	3140	0.635	142	451
4	2.12	1.56	322	33	953	786	3250	172	133	372
7	1.57	1.56	322	0.064	1270	1.21	3310	0.635	127	107
7	1.56	1.56	324	0.064	2310	1.21	3270	0.635	133	395
9	9.95	1.56	304	2.17	1160	219	3090	59.8	120	695
7	1.92	1.56	302	0.064	1980	1.21	3090	0.635	128	56.6
7	7.8	1.56	327	0.064	2010	1.21	3170	0.635	182	59.2
31	7.8	1.56	330	0.064	1730	1.21	3170	39.8	185	59.2
7	7.8	1.56	333	0.064	1480	1.21	3500	0.635	183	22.8
7	7.8	1.56	307	0.064	1390	1.21	2940	0.635	173	59.2
.4	7.8	2.25	331	13.1	1850	1.21	3200	97.9	178	59.2
7	7.8	1.56	329	0.064	1550	1.21	3200	0.635	168	1.63
7	7.8	1.56	321	0.064	1800	1.21	3150	0.635	177	8.17
23	7.8	1.56	335	0.331	1460	12.1	3180	29.3	163	59.2
17	7.8	1.56	317	0.064	1520	1.21	3130	0.635	173	0.449
17	7.8	1.56	320	0.064	1090	1.21	3060	0.635	165	0.449
29	7.8	1.56	136	0.064	480	1.21	1000	0.635	160	59.2
17	7.8	1.56	201	0.064	736	1.21	1740	0.635	155	59.2
17	7.8	1.56	215	0.429	843	1.21	1920	0.635	160	59.2
.5	7.8	1.56	127	59.4	299	30.3	959	112	159	59.2
17	7.8	1.56	191	0.064	674	1.21	1660	0.635	156	59.2
17	7.8	1.56	237	0.064	754	1.21	2010	0.635	162	59.2
.4	7.8	1.56	316	15.1	1200	30.3	3120	63.6	160	59.2
17	7.8	1.56	216	0.064	863	1.21	1970	0.635	161	59.2
17	7.8	1.56	179	0.064	682	1.21	1590	0.635	153	59.2
62	7.8	1.56	325	0.38	1960	1.21	3090	14.4	158	59.2
26	7.8	1.56	309	0.318	1560	965	3310	338	356	218
90	7.8	1.56	309	0.311	1350	468	3200	354	163	230
10	7.8	1.56	304	0.891	1350	1310	3210	734	163	315
17	7.8	1.56	297	0.064	1310	24.2	3150	0.635	153	253

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TABLE 6 - FIELD PILOT TEST

ULTROX P-650 Pilot Program - U

Phase 2 - W

Run #	Time	Date	Ozone Dose Rate	Ozone Dosage	Flow	Retention Time	pH	H2o2	RDX Influent	RDX Effluent
1	11:45 - 14:45	27-Oct	1.5	226.74	4.3	151.16	7	n/a	2380	<1.17
2	15:05 - 18:05	27-Oct	1.5	135.42	7.2	90.28	7	n/a	1220	<1.17
3	18:15 - 21:15	27-Oct	1.5	45.14	21.6	30.09	7	n/a	2250	<1.17
4	21:30 - 00:30	28-Oct	2.5	377.91	4.3	151.16	7	n/a	2220	<1.17
5	01:00 - 04:00	28-Oct	2.5	225.69	7.2	90.28	7	n/a	2280	<1.17
6	04:15 - 07:15	28-Oct	2.5	75.23	21.6	30.09	7	n/a	2180	<1.17
7	07:30 - 10:30	28-Oct	3.5	529.07	4.3	151.16	7	n/a	2310	<1.17
8	10:45 - 13:45	28-Oct	3.5	315.97	7.2	90.28	7	n/a	2360	<1.17
9	13:55 - 16:55	28-Oct	3.5	105.32	21.6	30.09	7	n/a	2350	<1.17
10	19:15 - 22:15	28-Oct	1.5	226.74	4.3	151.16	5	n/a	2270	<1.17
11	22:45 - 01:45	29-Oct	1.5	135.42	7.2	90.28	5	n/a	2350	<1.17
12	02:10 - 05:10	29-Oct	1.5	45.14	21.6	30.09	5	n/a	2240	<1.17
13	05:30 - 08:30	29-Oct	2.5	377.91	4.3	151.16	5	n/a	2600	<1.17
14	09:00 - 12:00	29-Oct	2.5	225.69	7.2	90.28	5	n/a	2300	<1.17
15	12:20 - 15:20	29-Oct	2.5	75.23	21.6	30.09	5	n/a	2260	<1.17
16	15:40 - 18:40	29-Oct	3.5	529.07	4.3	151.16	5	n/a	972	1.17
17	19:00 - 22:00	29-Oct	3.5	315.97	7.2	90.28	5	n/a	2240	1.17
18	22:10 - 01:10	30-Oct	3.5	105.32	21.6	30.09	5	n/a	2290	1.17
19	08:00 - 11:00	30-Oct	1.5	226.74	4.3	151.16	9	n/a	1170	1.17
20	11:20 - 14:20	30-Oct	1.5	135.42	7.2	90.28	9	n/a	2320	1.39
21	14:35 - 17:35	30-Oct	1.5	45.14	21.6	30.09	9	n/a	2340	2.28
22	17:45 - 20:45	30-Oct	2.5	377.91	4.3	151.16	9	n/a	2420	1.17
23	21:05 - 00:05	31-Oct	2.5	225.69	7.2	90.28	9	n/a	1390	1.17
24	00:40 - 02:40*	31-Oct	2.5	75.23	21.6	30.09	9	n/a	1320	1.17
25	03:00 - 06:00	31-Oct	3.5	529.07	4.3	151.16	9	n/a	1970	1.17
26	11:00 - 14:00	01-Nov	3.5	315.97	7.2	90.28	9	n/a	2100	1.17
27	14:15 - 17:15	01-Nov	3.5	105.32	21.6	30.09	9	n/a	2140	1.17
28	17:55 - 20:55	01-Nov	3.5	529.07	4.3	151.16	7	1.2	1940	33.9
29	21:20 - 00:20	02-Nov	3.5	315.97	7.2	90.28	7	1.2	1990	74.9
30	00:50 - 03:50	02-Nov	3.5	105.32	21.6	30.09	7	1.2	2340	335
31	15:30	02-Nov	3.5	529.07	4.3	151.16	7	n/a	1960	1.17

* Daylight Savings Time Began

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TABLE 6 - FIELD PILOT TEST ANALYTICAL RESULTS

ULTROX P-650 Pilot Program - UMATILLA DEPOT ACTIVITY

Phase 2 - Well 4-13

one age	Flow	Retention Time	pH	H2o2	RDX Influent	RDX Effluent	TETRYL Influent	TETRYL Effluent	2,4 DNT Influent	2,4 DNT Effluent	HMX Influent	HMX Effluent	2,4 Inf
.74	4.3	151.16	7	n/a	2380	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.42	7.2	90.28	7	n/a	1220	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.14	21.6	30.09	7	n/a	2250	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.91	4.3	151.16	7	n/a	2220	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.69	7.2	90.28	7	n/a	2280	<1.17	1.56	<1.56	.064	<.064	61	<1.21	
.23	21.6	30.09	7	n/a	2180	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.07	4.3	151.16	7	n/a	2310	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.97	7.2	90.28	7	n/a	2360	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.32	21.6	30.09	7	n/a	2350	<1.17	1.56	<1.56	.064	<.064	60.5	<12.1	
.74	4.3	151.16	5	n/a	2270	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.42	7.2	90.28	5	n/a	2350	<1.17	1.56	<1.56	.064	<.064	31.1	<1.21	
.14	21.6	30.09	5	n/a	2240	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.91	4.3	151.16	5	n/a	2600	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.69	7.2	90.28	5	n/a	2300	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.23	21.6	30.09	5	n/a	2260	<1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.07	4.3	151.16	5	n/a	972	1.17	1.56	<1.56	.064	<.064	60.5	<1.21	
.97	7.2	90.28	5	n/a	2240	1.17	1.84	<1.56	.064	<.064	60.5	<1.21	
.32	21.6	30.09	5	n/a	2290	1.17	1.77	<1.56	.064	<.064	60.5	<1.21	
.74	4.3	151.16	9	n/a	1170	1.17	7.80	<1.56	0.319	<.064	21.1	4.59	
.42	7.2	90.28	9	n/a	2320	1.39	7.80	<1.56	0.319	<.064	31.9	5.17	
.14	21.6	30.09	9	n/a	2340	2.28	7.80	<1.56	0.319	<.064	34.2	7.78	
.91	4.3	151.16	9	n/a	2420	1.17	7.80	<1.56	0.319	<.064	32.6	1.26	
.69	7.2	90.28	9	n/a	1390	1.17	7.80	<1.56	0.319	<.064	30.3	<1.21	
.23	21.6	30.09	9	n/a	1320	1.17	7.80	<1.56	0.319	<.064	30.5	13.1	
.07	4.3	151.16	9	n/a	1970	1.17	7.80	<1.56	0.319	<.064	28.6	<1.21	
.97	7.2	90.28	9	n/a	2100	1.17	7.80	<1.56	0.319	<.064	31.5	2.45	
.32	21.6	30.09	9	n/a	2140	1.17	7.80	<1.56	0.319	<.064	28	14.1	
.07	4.3	151.16	7	1.2	1940	33.9	7.80	<1.56	0.319	<.064	24.2	2.43	
.97	7.2	90.28	7	1.2	1990	74.9	7.80	<1.56	0.319	<.064	17.5	4.41	
.32	21.6	30.09	7	1.2	2340	335	7.80	<1.56	0.319	<.064	20	13.8	
.07	4.3	151.16	7	n/a	1960	1.17	7.80	<1.56	0.319	<.064	24.9	1.67	

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T ANALYTICAL RESULTS

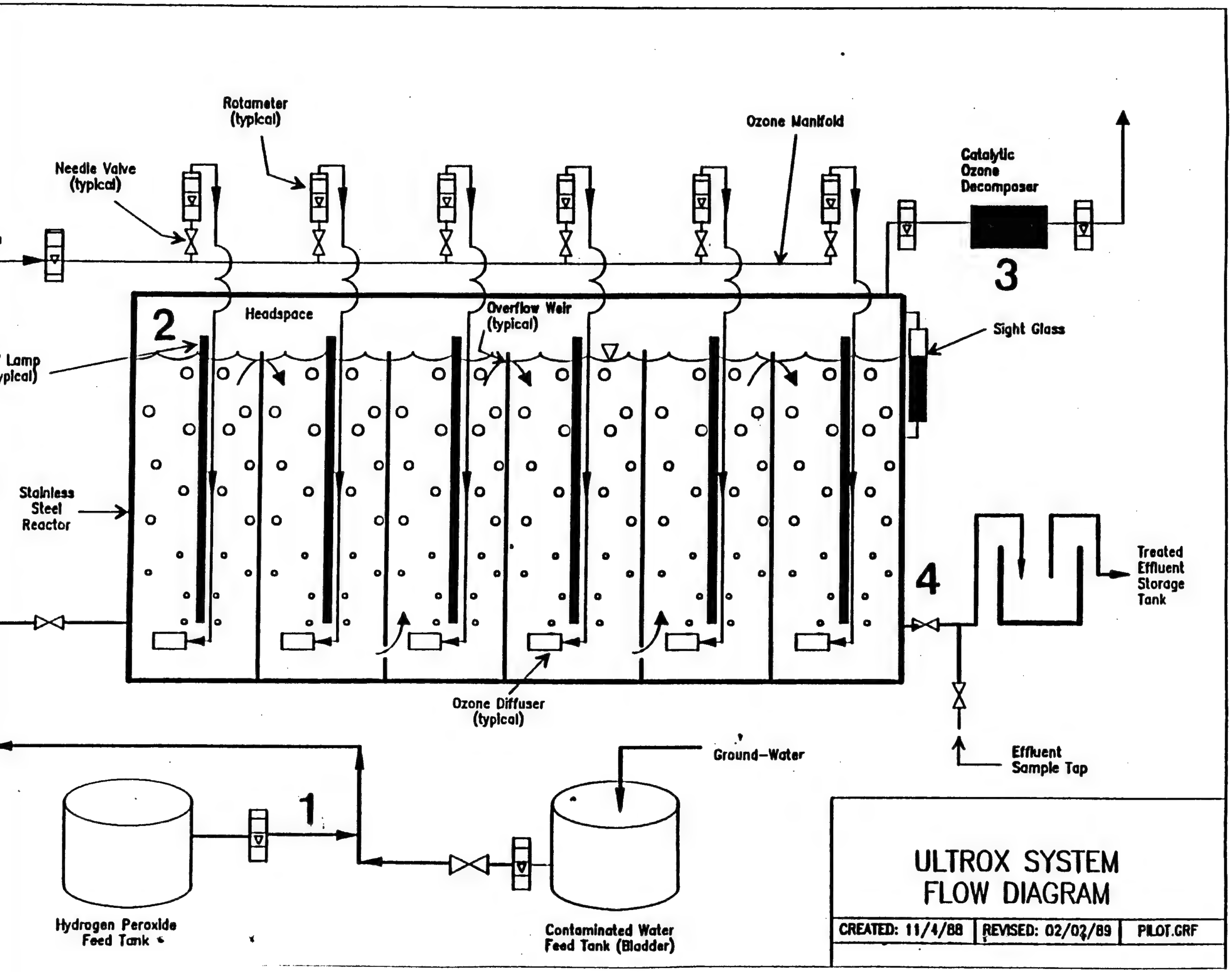
UMATILLA DEPOT ACTIVITY

Well 4-13

TETRYL Influent	TETRYL Effluent	2,4 DNT Influent	2,4 DNT Effluent	HMX Influent	HMX Effluent	2,4,6-TNT Influent	2,4,6-TNT Effluent	1,3,5-TNB Influent	1,3,5-TNB Effluent
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2.74	21.8
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	3.29	55.6
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2.4	178
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	3.08	7.44
1.56	<1.56	.064	<.064	61	<1.21	0.635	<0.635	3.17	58.4
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2.8	138
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	3.89	12.3
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	1.71	22.5
1.56	<1.56	.064	<.064	60.5	<12.1	0.635	<0.635	2.31	121
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2.68	<0.449
1.56	<1.56	.064	<.064	31.1	<1.21	0.635	<0.635	2.89	0.764
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2.21	74.1
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	1.98	<0.449
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	3.27	<0.449
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	3.48	29.9
1.56	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	1.93	<0.449
1.84	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2.01	<0.449
1.77	<1.56	.064	<.064	60.5	<1.21	0.635	<0.635	2	4.91
7.80	<1.56	0.319	<.064	21.1	4.59	3.18	<0.635	4.98	37.8
7.80	<1.56	0.319	<.064	31.9	5.17	3.18	<0.635	2.85	98.4
7.80	<1.56	0.319	<.064	34.2	7.78	3.18	<0.635	5.23	185
7.80	<1.56	0.319	<.064	32.6	1.26	3.18	<0.635	5.56	37
7.80	<1.56	0.319	<.064	30.3	<1.21	3.18	<0.635	5.71	94
7.80	<1.56	0.319	<.064	30.5	13.1	3.18	<0.635	4.41	211
7.80	<1.56	0.319	<.064	28.6	<1.21	3.18	<0.635	5.72	45.8
7.80	<1.56	0.319	<.064	31.5	2.45	3.18	<0.635	2.72	92.8
7.80	<1.56	0.319	<.064	28	14.1	3.18	<0.635	2.95	23.1
7.80	<1.56	0.319	<.064	24.2	2.43	3.18	<0.635	3.56	3.65
7.80	<1.56	0.319	<.064	17.5	4.41	3.18	<0.635	3.51	3.22
7.80	<1.56	0.319	<.064	20	13.8	3.18	<0.635	2.25	6.47
7.80	<1.56	0.319	<.064	24.9	1.67	3.18	<0.635	3.89	7.95

3

PROCESS FLOW DIAGRAM


Rotameter (typical)
Ozone Manifold
Needle Valve (typical)
Catalytic Ozone Decomposer
Ozone from ozone generator
3
2
Headspace
Overflow Weir (typical)
Sight Glass
UV Lamp (typical)
Stainless Steel Reactor
4
Treated Effluent Storage Tank
Ozone Diffuser (typical)
Ground-Water
Effluent Sample Tap
1
Hydrogen Peroxide Feed Tank
Contaminated Water Feed Tank (Bladder)
ULTROX SYSTEM FLOW DIAGRAM
CREATED: 11/4/88
REVISED: 02/02/89
PILOT.GRF

FIELD ENGINEER'S DAILY

LOG & NOTES

Umatilla Army Depot
Dames & Moore Pilot Project
Well 4-1

Date: 10-11-93 Monday
Onsite: 07:30 am
Depart Site: 06:00 pm
Total Hours: 10 hrs 30 min

Called High Purity Chemicals, and they said that it should be coming in the afternoon. 01:45 pm the chemicals finally arrived. They were still switching out the pumps, and after that, they will have to calibrate the pumps. It will take all day tuesday for them to do their step test on the pumps. So the schedule for now is, that we will start the treatment on wednesday. We are just running the system to train the crew, and also get the system ready and adjusted. It looks like both wells will be pumping more than expected. Kevin and I decided that when it comes to pH adjustment, we will have to adjust it as batch.

Date: 10-12-93 Tuesday
Onsite: 07:30 am
Depart Site: 07:00 pm
Total Hours: 11 hrs 30 min

More training and also treating the water form the pump test. They had to redo their step test on the two wells, so now well 4-1 is pumping at 36 gpm and well 4-13 will pump at 60 gpm.

Date: 10-13-93 Wednesday
Onsite: 07:30 am
Depart Site: 08:15 pm
Total Hours: 12 hrs 45 min

Totalizer started at 1360979. Started the test at 11:00 am. dosages and flowrates are set for 1.5 mg/l/min and started 4.3 gpm. Flows have to be adjusted constantly for the correction of the head pressure inside the baker tank. The pump test was stop, because the flowrate was too high, and that the well was getting too much of a draw-down. They lower the flowrate and resume pumping at 2:30 pm. But the treatability study kept on going.

Date: 10-14-93 Thursday
Onsite: 07:30 am
Depart Site: 08:30 pm
Total Hours: 13 hrs 00 min

Test #1 through #6 completed over night. Started test #7 with O_3 dose of 3.5. The system is holding up pretty good. The pump test flowrate is still too high. They are going to shut the pumps down at 11:30 am and start over later. the treatability study will also be shut down during this time. Well 4-1 will probably be pumping at 15 gpm. I switch the metering pumps around so that I can pump at a slow rate. for the new flow. The flowrate will be 14 gpm form well 4-1. They will probably start the treatment system at midnight.

Date: 10-15-93 Friday
Onsite: 07:15 am
Depart Site: 10:00 pm
Total Hours: 14 hrs 45 min

Completed test #8 and #9. I will setup for the pH down to a pH of 5. Started next set of runs at 11:00 am. The sulfuric acid at 10% is taking a lot to adjust the water down to 5. 20 gallons of 1N will adjust 8000 gallons at pH of 5. I ordered 25% solution sulfuric acid, and Dames & Moore will have someone pick it up and deliver it onsite. I can only get 15 gallons of the 24% solution. The 25% solution took a lot less than the 1N, and it also mixes into the water quicker. Trained dayshift on how to adjust the metering pump.

Date: 10-16-93 Saturday
Onsite: 07:15 am
Depart Site: 06:00 pm
Total Hours: 10 hrs 45 min

Completed test up to #15. The pH was running a little low, because nightshift didn't know which area to maintain the pH at. The pH was going into the baker tank at 5, but entering the reactor at 3.3. I had to shut the metering pump of at let the pH come up to 5. After the set of pH 5 test was done, I hooked up the other metering pump to adjust the pH up to 9 with the sodium hydroxide.

Date: 10-17-93 Sunday
Onsite: 07:15 am
Depart Site: 06:00 pm
Total Hours: 10 hrs 45 min

Completed up to test #20. The system is still holding up pretty good. But the sump pump float switch went bad on me. I went into town to look for another switch, but all I can get was a sump pump with a float switch. I bought the pump and replaced the float switch. I also bought some fittings to set the new pump up as a back-up pump. I took the other metering pump and washed it out and got it ready for the H_2O_2 test. I had to come back out to the site, because I forgot to open the valve on the sump pump fully open when I was working on the float switch.

Date: 10-18-93 Monday
Onsite: 07:15 am
Depart Site: 06:00 pm
Total Hours: 10 hrs 45 min

Completed up to test #27. I let the 6500 tank drain through the system, and flush it out to let the pH get back to neutral. I set up the H_2O_2 pump to inject into the reactor. We will wait till later in the afternoon to start the O_3 and H_2O_2 test, so that ozone generator will be a little cooler. After the $_2O_2$ test, we will just treat the water at 14 gpm until the pump test is completed. We started the O_3 and H_2O_2 test at 4:00 pm.

Sulfuric acid took at 1N to adjust 8000 gallons and 25% solution 8 gallons to adjust 14000 gallons.

Date: 10-19-93 Tuesday
Onsite: 07:30 am
Depart Site: 05:30 pm
Total Hours: 10 hrs 00 min

Completed test #27 to #29. The ozone generator did not quite make the dose of 3.5 mg/l/min. The actual was 3.3 mg/l/min. Removed the H_2O_2 pump and cleaned up around the area a little bit. And started to treat the pump test water at 14 gpm and O_3 dose of 2.5 mg/l/min. The sulfuric acid will not arrive until tomorrow. I order a oil filter and 5 gallons of oil to do the oil change on the diesel generator.

Date: 10-14-93 Wednesday
Onsite: 07:30 am
Depart Site: 05:30 pm
Total Hours: 10 hrs 00 min

System is running fine. The sulfuric acid arrived, and still treating the pump test water.

Date: 10-15-93 Thursday
Onsite: 07:00 am
Depart Site: 12:00 pm
Total Hours: 5 hrs 00 min

Completed test #31 at 6:30 am. All samples were collected, and the treatability study is completed for phase 1 of the pump test. We are still treating the water that is in the baker tank before shutting down.

Umatilla Army Depot
Dames & Moore Pilot Project
Well 4-13

Date: 10-27-93 Wednesday
Onsite: 07:30 am
Depart Site: 07:00 pm
Total Hours: 11 hrs 30 min

Received the parts for Lehne & Son at the Hotel last night. Installed the mufflers for the dryer. Started pump test at 11:00 am, and the treatability test at 11:45 am. Had to train Mike, a new Dames & Moore person replacing Linda. The effluent pumps after the GAC was not able to keep up with the flowrate of the pump test and the high flowrate of the treatment system. They will have to add or change the pump for the high flowrates.

Date: 10-28-93 Thursday
Onsite: 07:30 am
Depart Site: 07:30 pm
Total Hours: 12 hrs 00 min

Complete test up to #7. The system is running fine. We are not quite making 3.5 mg/l/min. It is only producing 1.9% concentration. But with this well, it might not need all that much. I set up the metering pump for the sulfuric acid to adjust the pH. The pH adjustment to 5 will be going on later in the day. Started to adjust the pH at 18:30.

Date: 10-29-93 Friday
Onsite: 07:30 am
Depart Site: 05:30 pm
Total Hours: 10 hrs 00 min

Completed test up to #13. Had a little problem with the HC-12 monitor, but after switching on and off a couple of time, the monitor was work alright. They had a problem with the pH, but it ended up being a bad probe. They re-calibrated the pH probe and that corrected the meter. The system is running fine now. We used 9 gallons of sulfuric acid to adjust 22911 gallons of water to pH5.

Date: 10-30-93 Saturday
Onsite: 07:00 am
Depart Site: 05:30 pm
Total Hours: 10 hrs 30 min

Completed test up to #18. Kyle tried to pH adjust the water up to 9, but I had the wrong pump setup. When I arrived on-site, he said that he could only get the pH up to 8.6 when the pump was set to it's maximum. We switched out the pumps and sure enough, the setting of 40% was what we estimated on the pump. We started the set of pH 9 at 08:00 am. System running fine.

Date: 10-31-93 Sunday
Onsite: 07:30 am
Depart Site: 06:00 pm
Total Hours: 10 hrs 45 min

Completed test up to #25. System was running fine until the totalizer when bad. There was no flow going through the totalizer. At first we thought it was the gate valve in front of the totalizer. When we drained the reactor and took the valve apart, it would open and close. So we took a look at the totalizer. It seems that something is stuck inside the totalizer, jamming the paddle wheel, and we can't take it apart. There is a spare totalizer here, but we done have the flanges to connect it to the reactor. We will have to shutdown until tomorrow when the hardware stores are open. The system was shut down at 09:50 am. I removed the old totalizer and got it ready for the new one for tomorrow. We drained the 6500 gallon tank so that we will have a fresh batch of water when we start up tomorrow.

Date: 11-01-93 Monday
Onsite: 10:00 am
Depart Site: 06:00 pm
Total Hours: 08 hrs 00 min

When into town to look for a set of flange to pipe fitting. Nobody has it, so I went to Pursewell and asked Dennis. He didn't have any either, but he did sent me so somebody who can make one up. Kyle and I installed the new totalizer into the system and started test #26 at 11:00 am. I adjusted one baker tank to pH 9 then switched the pumps and setup for H_2O_2 injection. I had Heller & Son come and fill the diesel tank with 150 gallons more. We used 7.5 gallons of 20% sodium hydroxide to 28,217 gallons of water for the pH 9.

Date: 11-02-93 Tuesday
Onsite: 07:00 am
Depart Site: 05:00 pm
Total Hours: 10 hrs 00 min

Completed test up to #30. We are just treating the water until the end of the pump test which will be finish at 04:00 pm, and the last sample will be taken at 03:30 pm. I am injecting H_2O_2 just to give it more oxidant, and also using up all the H_2O_2. The pump trest

finished at 04:00 pm. The treatability test was completed at 03:30 pm, but we still have some water in the 6500 gallon baker tank for demostrations for tomorrow.

Date: 11-03-93 Wednesday
Onsite: 08:00 am
Depart Site: 06:00 pm
Total Hours: 10 hrs 00 min

Winds started to pick up quite a bite, the tent was coming apart. I had to take the tent down. I started the system up and got it ready for the demostration for Kevin Parrett. The last demostration was over at 05:00 pm. After the demostration, I started to drain the system.

Date: 11-04-93 Thursday
Onsite: 07:30 am
Depart Site: 01:00 pm
Total Hours: 5 hrs 30 min

I started to take the system apart. I removed all the parts that I borrowed from Dames & Moore, and started to package the pilot plant up. The baker tanks will be used until next week, so the plumbing was left on.

DAILY LOG

DATE: 9-27-93 MON

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 3:30 pm

TOTAL HOURS ON SITE: 8 hrs

NOTES: GOT BADGED AND VEHICLE REGISTRATION. System will be delayed to arrival.

DAILY LOG

DATE: 9-28-93 TUES

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 3:30 pm

TOTAL HOURS ON SITE: 8 hrs.

NOTES: Help set-up site trailer. Help out with plumbing.

DAILY LOG

DATE: 9-29-93 WED

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 3:30 pm

TOTAL HOURS ON SITE: 8:~~00~~ hrs.

NOTES: System hasn't arrived. Power generator showed up. Deisal fuel came.

DAILY LOG

DATE: 9-30-93 Thur

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 6:30 pm

TOTAL HOURS ON SITE: 11 hrs.

NOTES: System ~~[illegible]~~ arrived at 7:30 am, But had to wait for a escort to guide the driver to the site. Finally arrived on site at 11:30 am. Started to assemble the system.

DAILY LOG

DATE: 10-1-93 FRI

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 6:00 Pm

TOTAL HOURS ON SITE: 9.5 hrs

NOTES: Hook-up feed lines and generator for power. test out power generator.

DAILY LOG

DATE: 10-2-93 SAT

TIME ON SITE: 8:30 Am

TIME EXIT SITE: 5:00 Pm

TOTAL HOURS ON SITE: 8.5 hrs

NOTES: Check out pilot system. Fill UV tank with ground water. Test system for leaks and operation. Did not get a chance to check ozone generator.

DAILY LOG

DATE: 10-3-93 SUN

TIME ON SITE: 9:00 Am

TIME EXIT SITE: 5:00 pm

TOTAL HOURS ON SITE: 8 hrs

NOTES: Got water pumped into 6500 tank. Started UV ozone and checked out the system. Could not treat water on a flowthru, because the effluent plumbing was not connected.

DAILY LOG

DATE: 10-4-93 MSN

TIME ON SITE: 7:30 AM

TIME EXIT SITE: 6:00 pm

TOTAL HOURS ON SITE: 10½ hrs

NOTES: started to treat the ground water at 11 gpm and the ozone dosage of 2.5 mg/l/min. The water on the cooling gets a little warm when the ozone generator is at maximum output.

DAILY LOG

DATE: 10-5-93 Tues

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 6:00 Pm

TOTAL HOURS ON SITE: 10 hrs

NOTES: They are doing a step test on the wells pump. And I am treating the water from the test, and after words, it will be going thru the carbon filters (GAC). The ozone doses is at 2.5 mg/l/min, and the flowrate is 21 gpm.

DAILY LOG

DATE: 10-6-93

TIME ON SITE: 7:30 Am

TIME EXIT SITE:

TOTAL HOURS ON SITE:

NOTES: checked out of hotel. arrived onsite and started treating the water from the step test. ozone dose is at 2.5 mg/l and flow rate will vary.

DAILY LOG

DATE: 10-11-93 MON

TIME ON SITE: 7:30 am

TIME EXIT SITE: 6:00 pm

TOTAL HOURS ON SITE: 10½ hrs

NOTES: Called up the chemical store, and they said that ~~the~~ it should be there in the morning. 1:45 pm the chemical showed up. They were still switching out pumps, and after works, they will have to calibrate the pumps. It will take all day tuesday for them to do the step test. So, the schedule for now is, the treatment will start on Wednesday. We are just run the system ~~[illegible]~~ just for training and getting the system ready. It looks like both wells will be pumping more than what they were expecting. So Kevin & I decide that when it comes to ph adjust, it will be adjusted as a batch.

DAILY LOG

DATE: 10-12-93 TUES

TIME ON SITE: ~~0730~~ 07:30 am

TIME EXIT SITE: 7:00 pm

TOTAL HOURS ON SITE: ~~[illegible]~~ 11-1/2 hr

NOTES: Treat water and training. They had to redo ~~the~~ step test on the two wells, and so now well 4-1 is pumping at 36 gpm & well 4-13 will pump a 60 gpm.

DAILY LOG

DATE: 10-13-93 WED

TIME ON SITE: 7:30 am

TIME EXIT SITE: ~~20~~ 8:15 pm

TOTAL HOURS ON SITE: 12 hr 45 min

NOTES: TOTALIZER: 1360779. START TEST at 11:00 am dosage, and flowrate are set for 1.5 ozone, and starting at 4.3 gpm. Flows have to be adjusted constantly for the correction of head in the breaker tank level. The well test was stop, ~~[illegible]~~ because the flow rate was to high, and the well was getting to much of a drawn down. They resume pumping at 2:30 pm. But the treatability study kept going.

DAILY LOG

DATE: 10-14-93 THURS

TIME ON SITE: 07:30 am

TIME EXIT SITE: 8:30 pm

TOTAL HOURS ON SITE: 13 hr.

NOTES: Test #1 to #6 completed. Started test #7 with 3.5 [illegible] dose. The system is holding up OK. ~~[illegible]~~ Pump test flow rate is too high. They are going to shut down at 11:30 pm and start again later. The treatability will also be shut down also. Well 4-1 will probably be pumped at a rate of 15 gpm. I switched the metering pumps around so that I can pump at a slower rate. The new flow rate will be 14 gpm for well 4-1. They will probably start treatment at midnight.

DAILY LOG

DATE: 10-15-93 FRI

TIME ON SITE: 07:15 am

TIME EXIT SITE: 10:00 pm

TOTAL HOURS ON SITE: 14:45 hrs

NOTES: completed test #8 & #9. Will setup for ph adjustment down to 5 ph. It is taking alot of sulfuric acid to adjust the ph down to 5. Started next set of runs at 11:00 am the sulfuric acid at 10% was taking a lot to adjust the pH down to 5 20 gallons will adjust approximately 8000 gallons only. I order 25% acid call Dana & Moore had somebody from Kaiser Portland office pick it up and bring it on site. I only can get 15 gallons at 25%. The 25% solution took a lot less and it also mixes into the water quicker. Showed day shift how to adjust the metering pump.

DAILY LOG

DATE: 10/16/93 SAT

TIME ON SITE: 07:15 am

TIME EXIT SITE: 6:00 pm

TOTAL HOURS ON SITE: 10:45 hrs

NOTES: Completed test up to #5. The pH was running a little low because nightshift didn't know which area to maintain the pH and that it was going into the Baker tank at 5, but going into the UV reactor was 3.3. I had to shut the acid down a little bit to let the pH get back up to 5. After the set of test for PH 5 was completed, I hooked up the metering pump for the sodium hydroxide to start the next set of runs at pH 9.

DAILY LOG

DATE: 10-17-93 Sun

TIME ON SITE: 07:15 am

TIME EXIT SITE: 6:00 pm

TOTAL HOURS ON SITE: 10 hr 45 min

NOTES: Completed up to test # 20. The system is still holding up. But the sump pump float switch ~~[illegible]~~ broke down. I went into town to look for another switch, but all I can get was a sump pump with a float switch. I bought it and switched the switch onto the old pump and have this as a backup. ~~Got~~ ~~[illegible]~~ the H_2O_2 pumps and wash it out. I had to come back at 7:30 pm to open the valve on the sump pump because I had it closed down shot when I was fixing the float switch.

DAILY LOG

DATE: 10-18-93 MON

TIME ON SITE: 07:15 Am

TIME EXIT SITE: 6:00 pm

TOTAL HOURS ON SITE: 10hr 45min

NOTES: completed up to #27. let the 6500 tank drain and just let it run ~~to~~ flush the tank out. I set up the H_2O_2 injection into the reactor. We will wait ~~till~~ later in the afternoon so the generator will ~~[illegible]~~ run a little cooler. The well is pumping at 14 gpm, and so we will treat the water at 14 gpm without taking any samples. Started O_3 & H_2O_2 test at 4:00 pm. System running fine.

Sulfuric acid 20 gals @ 1N for 8,000 gals — 1 gal acid for 400 water.
approx 8 gallons @ 25% for 14,000 gals. — 1 gal acid for 1750 water
1:1750

HIGH PURITY CHEM 503-247-2985

PO# 32106890

UV
A-59

DAILY LOG

DATE: 10-19-93 TUES

TIME ON SITE: 07:30 Am

TIME EXIT SITE: 05:30 Am

TOTAL HOURS ON SITE: 10 hrs

NOTES: Completed O_3, H_2O_2 test. The ozone generator did not quite make 3.5 mg/l, It was putting out only 3.3 mg/l. Removed the H_2O_2 pump and cleaned up a little. Schedule for diesel generator service for Friday. Chemicals will probably arrive Wednesday. Order oil and filter for diesel generator. System still treating.

MIKE HAGY - HALTON 1-503-280-1515

PO# 10057 $\#$OC71753

1-503-720-7489

PARTS - [illegible] 7.90 FILTER 15-40 5 gals.

42.14

DAILY LOG

DATE: 10-20-93 WED.

TIME ON SITE: 7:30 Am

TIME EXIT SITE: 05:30 pm

TOTAL HOURS ON SITE: 10hrs

NOTES: system running fine sulfuric acid should arrive at noon today. Still nothing now. ~~tt~~

UV
A-61

DAILY LOG

DATE: 10-21-93 Tuesday

TIME ON SITE: 0700 am

TIME EXIT SITE:

TOTAL HOURS ON SITE:

NOTES: Completed test # 31 at 10:30 am all samples are collected and treatability test is completed for phase one of the pump test. Now we are just treating the remaining water in the Baker tank before shutting down. Change oil at diesel generator with 753 hrs.

START 551 hrs

DAILY LOG

DATE: 10-27-93 WEDNESDAY

TIME ON SITE: 07:30 AM

TIME EXIT SITE: 19:00 pm

TOTAL HOURS ON SITE: 12 hrs 30 min

NOTES: Recieved parts from Lohne & Son. Installed the muffler and the dryer. Started pump test at 11am, and the treatibility test at ~~#~~ 11:45 am. System operating good. The holding tank after the GAC is not able to keep up with flow, they will have to change or add another pump to handle 20 gpm.

DAILY LOG

DATE: 10-28-93 THURS

TIME ON SITE: 07:30 Am

TIME EXIT SITE: 07:30 pm

TOTAL HOURS ON SITE: 12 hrs 0 min

NOTES: System running fine. Completed test ~~Up to~~ #7. The ozone generator is not quite making 2.5 mg/l/min. It is only producing 1.9% concentration. ~~[illegible]~~ I set up the metering pump for the Sulfuric acid for the pH adjustment. It will be needed later on in the day. Started to pH adjust down to 5 at 12:30 hrs.

DAILY LOG

DATE: 10-29-93 FRI

TIME ON SITE: ~~[illegible]~~ 07:30 Am

TIME EXIT SITE: 17:30 pm

TOTAL HOURS ON SITE: 10 hrs.

NOTES: Completed test up to # 13. Had a little problem with the HC-12 monitor, but after switching off and on for awhile, it started to work alright. They had problems with the pH, but it ended up being a bad pH probe. They recalibrate the ~~pH~~ probe and the meter worked fine. The system is running fine.

We used 9 gallons of sulfuric acid to adjust 22911 gallons of water ~~to~~ to PH 5

190003
167092 9 gallons sulfuric
22911

DAILY LOG

DATE: 10-30-93 SAT

TIME ON SITE: 07:00 am

TIME EXIT SITE: 05:30 pm

TOTAL HOURS ON SITE: 10 hrs 30 min

NOTES: Complete test up to #18. Kyle tried to pH adjust the water up to pH 9, but I had the wrong pump set up. When I arrived onsite, he said that he could only get up to 8.6, then the pump was maxed. We switched out the pump and sure enough, the setting of 40% was what we estimated. We started the set up Test for pH 9 at 8:00 am

DAILY LOG

DATE: 10-31-93 Sun

TIME ON SITE: 07:30 Am

TIME EXIT SITE: 05:30 pm

TOTAL HOURS ON SITE: 10 hrs

NOTES: Completed test up to #25. System was running fine until the totalizer went bad. There was no flow going through the meter. At first, we thought that it was the gate valve but when we drained the reactor and took the valve apart ~~the~~ valve would open and close. It looks like the totalizer has something jamming the paddle wheel in the totalizer. There is an extra totalizer out here, but we don't have any flanges ~~[illegible]~~ to connect up to the reactor. We will have to shutdown and wait til tomorrow when the hardware store opens up. System down since 09:50 am. Remove the old totalizer and got it ready for the new one once we get the flanges. Drain 6500' bake tank, so that we can have a fresh batch when we start up again.

DAILY LOG

DATE: 11-1-93 Mon

TIME ON SITE: 10:00 Am

TIME EXIT SITE: 06:00 pm

TOTAL HOURS ON SITE: 8 hrs

NOTES: Went into town to look for a set of flange & pipe fitting. Nobody has it, so I went to Roosevelt and I ask Benson. He didn't have any either, but he did sent me to a man who could make one up. ~~[illegible]~~ Kyle and I installed the stabilizer into the system and started test #26 at 11:00 am. Adjust one batch tank to PH 9, then switch the pumps and setup for H_2O_2 injection. Ha & Delbert and Ron come out and fill up the diesel with 150 gallons more.

7.5 gals of 20% sodium hydroxide for 28,217

21822 0   28,217
~~250083~~
19000

DAILY LOG

DATE: 11-2-93 Tues

TIME ON SITE: 07:00 Am

TIME EXIT SITE:

TOTAL HOURS ON SITE:

NOTES: Completed test up to #30. We are just treating until the end of the pump test. The pump test will be finish at 04:00 pm and the last sample will be taken at 03:30 pm. I am injecting H_2O_2 just to give it more oxidant and also using up the H_2O_2 202. Pump test finished at 04:00 pm. Treatability test was completed at 03:30 but we still have some water in 6500 Baker tank for demonstration for tomorrow.

UV
A-69

DAILY LOG

DATE: 11-3-93 WED

TIME ON SITE: 08:00 am

TIME EXIT SITE: 06:00 pm

TOTAL HOURS ON SITE: 10hrs

NOTES: Winds picking up quite a bite, the tent is coming apart. I had to take the tent down. I started the systems up and got it ready for the demonstration for Kevin. The demonstration was over at 05:00 pm, started to drain the system.

UV
A-70

DAILY LOG

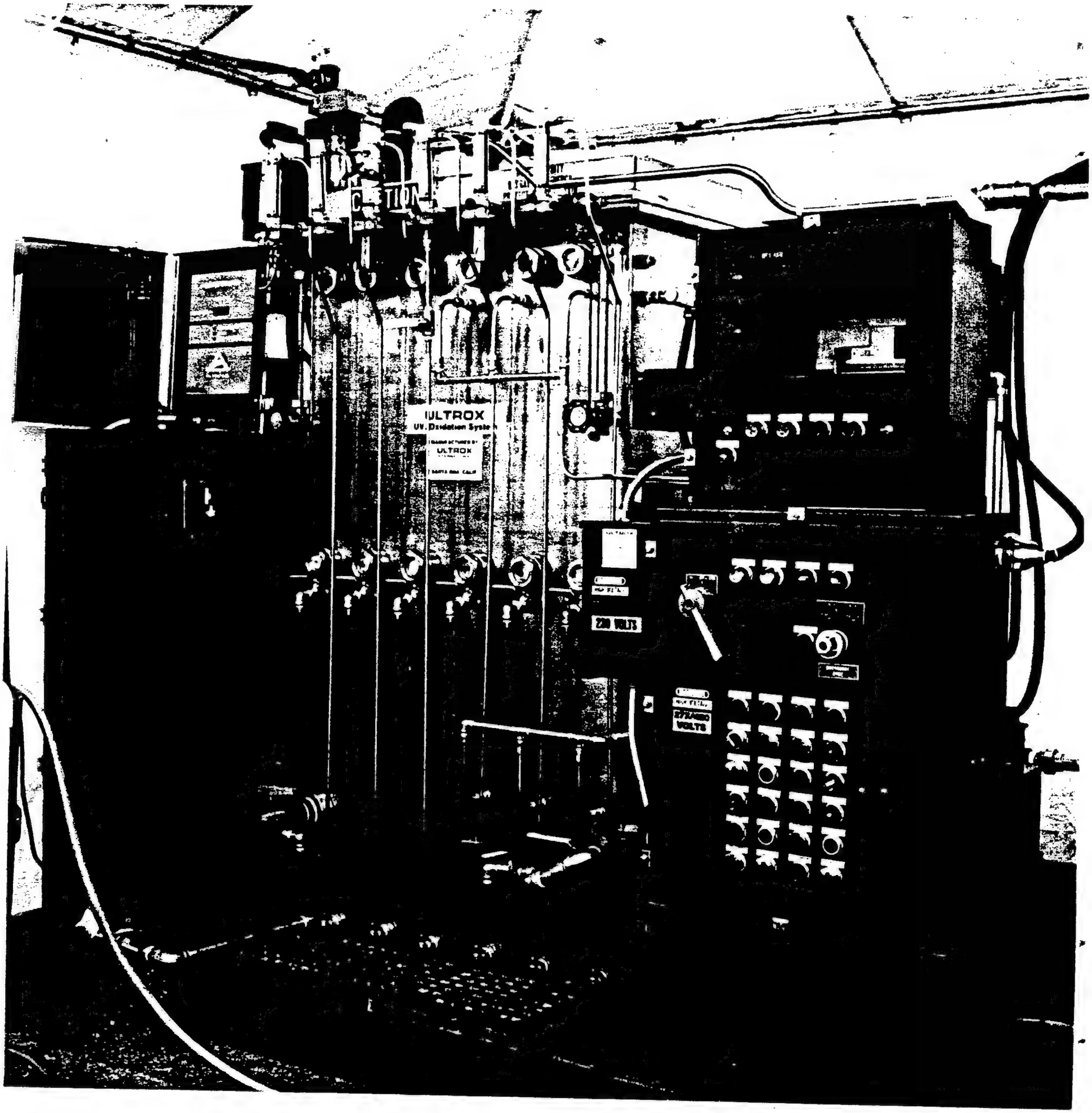
DATE: 11-4-93 Thurs

TIME ON SITE: 07:30 am

TIME EXIT SITE: 1:00 pm

TOTAL HOURS ON SITE: 5 hrs 30 min

NOTES: Started to take system apart. Removed all the parts that I borrowed from Dames & Moore and started to package the pilot plant up. The Baker tanks will be used until next week, so the plumbing was left on.



ULTROX® UV/OXIDATION WATER TREATMENT SYSTEM

APPENDIX B:

Sample Collection Log

TREATABILI TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SAMPLE COLLECTION LOG

PUMPING WELL 4-1

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
0	n/a	n/a	n/a	n/a	X			G01I00(F or L)	n/a	10:30/10-13	7.83	520	24020	39141	KGP
1	1.5	4.3	7	0	X			G01I01(F or L)	10:45	14:45	7.69	728	28400	39141	KS
						X		G01U01(F or L)			7.34	796		39141	KS
							X	G01E01(F or L)			8.24	872		39141	KS
2	1.5	7.2	7	0	X			G01I02 (F or L)	15:15	18:15	7.68	203	30756	43762	KS
						X		G01U02(F or L)			7.91	752			KS
							X	G01E02(F or L)			8.27	786			KS
3	1.5	21.6	7	0	X			G01I03(F or L)	18:35	21:35	7.69	670	35752	22:05 46453	KS
						X		G01U03(F or L)			7.51	695			KS
							X	G01E03(F or L)			8.16	714			KS
4	2.5	4.3	7	0	X			G01I04(F or L)	22:00	10/14 01:00	7.68	763	35766	01:10 52560	LD
						X		G01U04(F or L)			8.12	769			LD
							X	G01E04(F or L)			8.28	758			LD
5	2.5	7.2	7	0	X			G01I05(F or L)	01:35	0435	7.38	740	35766	59298	LD
						X		G01U05(F or L)			7.74	803			LD
							X	G01E05(F or L)			7.91	792			LD
6	2.5	21.6	7	0	X			G01I06(F or L)	0455	0755	7.38	772	40550	61164	LD
						X		G01U06(F or L)			7.44	784			LD
							X	G01E06(F or L)			7.89	~~789~~ 759			LD
7	3.5	4.3	7	0	X			G01I07(F or L)	0815	1115	7.62	764	40550	67784	LD
					X			G01I07(F or L)D			7.62	764			LD
						X		G01U07(F or L)			8.17	744			LD
							X	G01E07(F or L)			8.30	722			LD
8	3.5	7.2	7	0	X			G01I08(F or L)	0130	10/15/0430	7.60	826	0440 43481	71113	LD
						X		G01U08(F or L)			7.84	866			LD

TREATABILI TESTS

SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY

UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON

SAMPLE COLLECTION LOG

PUMPING WELL 4-1

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TSI) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G01E08(F or L)	0130	10/15/0430	7.79	810	43481	71113	LD
9	3.5	21.6	7	0	X			G01I09(F or L)	0500	10/16/0800	7.36	735	43481	73766	LD
						X		G01U09(F or L)	↓	↓	7.51	792	↓	↓	LD
							X	G01E09(F or L)	↓	↓	7.79	762	↓	↓	LD
10	1.5	4.3	5	0	X			G01I10(F or L)	1100	10/16/14:00	5.48	1011	47452	75157	KS
						X		G01U10(F or L)	↓	↓	7.35	843	↓	↓	KS
							X	G01E10(F or L)	↓	↓	8.21	758	↓	↓	KS
11	1.5	7.2	5	0	X			G01I11 (F or L)	14:30	17:30	5.82	763	50319	75157	KS
						X		G01U11(F or L)	↓	↓	6.41	819	↓	↓	KS
							X	G01E11(F or L)	↓	↓	8.19	805	↓	↓	KS
12	1.5	21.6	5	0	X			G01I12(F or L)	17:45	20:45	7.60	762	50506	77706	KS
						X		G01U12(F or L)	↓	↓	6.00	814	↓	↓	KS
							X	G01E12(F or L)	↓	↓	8.32	791	↓	↓	KS
13	2.5	4.3	5	0	X			G01I13(F or L)	21:00	24:00 10/16	7.50	644	53358 00:05	77713	KS
						X		G01U13(F or L)	↓	↓	4.02	712	↓	↓	LD
							X	G01E13(F or L)	↓	↓	6.48	756	↓	↓	LD
							X	G01E13(F or L)D	↓	↓	6.48	756	↓	↓	LD
14	2.5	7.2	5	0	X			G01I14(F or L)	01:05	0405	6.28	714	67841 04:40	77713	LD
						X		G01U14(F or L)	↓	↓	6.50	764	↓	↓	LD
							X	G01E14(F or L)	↓	↓	6.65	751	↓	↓	LD
15	2.5	21.6	5	0	X			G01I15(F or L)	0435	0635	5.70	728	58886	77713	LD
						X		G01U15(F or L)	↓	↓	3.50	858	↓	↓	LD
							X	G01E15(F or L)	↓	↓	6.31	784	↓	↓	LD
16	3.5	4.3	5	0	X			G01I16(F or L)	0705	1005	6.21	536	61841	77713	LD
						X		G01U16(F or L)	↓	↓	3.52	951	↓	↓	LD

TREATABILITY TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SAMPLE COLLECTION LOG

PUMPING WELL 4-1

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G01E16(F or L)	0705	1005	6.61	815	61841	77713	LD
17	3.5	7.2	5	0	X			G01I17(F or L)	10:20	13:20	6.77	832	62151	80070	KS
						X		G01U17(F or L)			4.90	900			KS
							X	G01E17(F or L)			7.00	888			KS
18	3.5	21.6	5	0	X			G01I18(F or L)	13:50	15:50	6.65	867	62151	82178	KS
						X		G01U18(F or L)			6.49	880			KS
							X	G01E18(F or L)			7.30	893			KS
19	1.5	4.3	9	0	X			G01I19(F or L)	17:30	20:30	9.21	835	65207	83086	KS
						X		G01U19(F or L)			8.60	893			KS
							X	G01E19(F or L)			8.36	816			KS
20	1.5	7.2	9	0	X			G01I20(F or L)	21:00	24:00	9.25	812	68168	83086	KS
						X		G01U20(F or L)			8.87	805			KS
						X		G01U20(F or L)D			8.87	805			KS
							X	G01E20(F or L)			8.42	770			LD
21	1.5	21.6	9	0	X			G01I21(F or L)	00:50	0350	9.21	771	71748	83086	LD
						X		G01U21(F or L)			9.18	775			LD
							X	G01E21(F or L)			8.60	813			LD
22	2.5	4.3	9	0	X			G01I22(F or L)	0430	0730	9.49	832	74693	83086	LD
						X		G01U22(F or L)			8.61	828			LD
							X	G01E22(F or L)			8.39	805			LD
23	2.5	7.2	9	0	X			G01I23(F or L)	0805	1105	9.31	808	77680	83086	LD
						X		G01U23(F or L)			8.76	783			LD
							X	G01E23(F or L)			8.32	764			LD
24	2.5	21.6	9	0	X			G01I24(F or L)	1135	1435	9.20	840	80387	83086	MAC
						X		G01U24(F or L)			8.93	833			MAC

TREATABILI' TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SAMPLE COLLECTION LOG

PUMPING WELL 4-1

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G01E24(F or L)	11:35	14:35	8.55	875	80389	83086	MAC
25	3.5	4.3	9	0	X			G01I25(F or L)	15:05	18:05	8.32	832	82576	83826	KS
						X		G01U25(F or L)			8.73	869			KS
							X	G01E25(F or L)			8.36	719			KS
26	3.5	7.2	9	0	X			G01I26(F or L)	18:25	21:25	8.33	767	82576	86623	KS
						X		G01U26(F or L)			8.37	763			KS
							X	G01E26(F or L)			8.29	762			KS
27	3.5	21.6	9	0	X			G01I27(F or L)	21:50	00:55	9.00	736	01:10 82851	87491	LJ
					X			G01I27(F or L)D			9.20	736			LJ
						X		G01U27(F or L)			8.28	714			LJ
							X	G01E27(F or L)			8.16	806			LJ
28	3.5	4.3 wo/UV	7	1.2	X			G01I28(F or L)	16:00	19:00	7.69	739	98018	89491	MAO/KS
						X		G01U28(F or L)			7.99	731			KS
							X	G01E28(F or L)			7.91	758			KS
29	3.5	7.2 wo/UV	7	1.2	X			G01I29(F or L)	~~2~~19:15	22:15	7.75	709	22:23 100,845	89491	KS
						X		G01U29(F or L)			6.00	706			KS
							X	G01E29(F or L)			7.95	747			KS
30	3.5	21.6 wo/UV	7	1.2	X			G01I30(F or L)	22:45	01:45	7.73	825	103653	89491	LJ
						X		G01U30(F or L)			7.87	773			LJ
							X	G01E30(F or L)			8.17	762			LJ
31	3.5	4.3	7	0	X			G01I31(F or L)	0200	0500	7.65	830	106363	89491	LJ
						X		G01U31(F or L)			7.44	[illegible]			LJ
							X	G01E31(F or L)			8.28	781			LJ
							X	G01E31(F or L)D			8.28	781			LJ

File:TREAT01.XLS
F = Field Laboratroy Sample
L = Contract Laboratory Sample
D = Duplicate Sample Required
TS = Treatment System
BP = Bypass System

DAMES & MOORE

UV
B-5

TREATABIL. TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON

PUMPING WELL 4-1

SAMPLE COLLECTION LOG

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G01E26(F or L)							
27	3.5	21.6	9	0	X			G01I27(F or L)							
					X			G01I27(F or L)D							
						X		G01U27(F or L)							
							X	G01E27(F or L)							
28	3.5	4.3 wo/UV	7	1.2	X			G01I28(F or L)							
						X		G01U28(F or L)							
							X	G01E28(F or L)							
29	3.5	7.2 wo/UV	7	1.2	X			G01I29(F or L)							
						X		G01U29(F or L)							
							X	G01E29(F or L)							
30	3.5	21.6 wo/UV	7	1.2	X			G01I30(F or L)							
						X		G01U30(F or L)							
							X	G01E30(F or L)							
31	3.5	4.3	7	0	X			G01I31(F or L)	0600	0630	7.82	777	147935	89491	[illegible]
						X		G01U31(F or L)	↓	↓	8.14	823	↓	↓	[illegible]
							X	G01E31(F or L)	↓	↓	7.87	807	↓	↓	[illegible]
							X	G01E31(F or L)D	↓	↓	7.87	807	↓	↓	[illegible]

File:TREAT01.XLS

F = Field Laboratroy Sample

L = Contract Laboratory Sample

D = Duplicate Sample Required

TS = Treatment System

BP = Bypass System

DAMES & MOORE

TREATABILI TESTS

SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY

UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON

SAMPLE COLLECTION LOG

PUMPING WELL 4-13

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TB) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
0	n/a	n/a	n/a	n/a	X			G13I00(F or L)	10-27-93 n/a	11:10	7.68	880	15400	89490	MU
1	1.5	4.3	7	0	X			G13I01(F or L)	1145	1445	7.79	910	15493	98275	MU
						X		G13U01(F or L)	1145	1445	8.23	966	15493	98275	MU
							X	G13E01(F or L)	1145	1445	7.92	890	15493	98275	MU
2	1.5	7.2	7	0	X			G13I02 (F or L)	1505	1805	7.72	934	15493	108980	MU
						X		G13U02(F or L)	1505	1805	8.05	914	15493	108980	MU
							X	G13E02(F or L)	1505	1805	8.26	922	15493	108980	MU
3	1.5	21.6	7	0	X			G13I03(F or L)	1815	2115	7.76	829	157168	118650	MU
						X		G13U03(F or L)	1815	2115	7.83	831	157168	118650	MU
							X	G13E03(F or L)	1815	2115	8.37	823	157168	118650	MU
4	2.5	4.3	7	0	X			G13I04(F or L)	2130	0030	7.83	822	157168	129559	KS
						X		G13U04(F or L)	↓	↓	8.19	865	↓	↓	KS
							X	G13E04(F or L)	↓	↓	8.32	852	↓	↓	KS
5	2.5	7.2	7	0	X			G13I05(F or L)	0100	0400	7.84	827	162685	137261	KS
						X		G13U05(F or L)	↓	↓	8.04	875	↓	↓	KS
							X	G13E05(F or L)	↓	↓	8.22	862	↓	↓	KS
6	2.5	21.6	7	0	X			G13I06(F or L)	0415	0715	7.84	803	162685	148530	KS
						X		G13U06(F or L)	↓	↓	7.91	858	↓	↓	KS
							X	G13E06(F or L)	↓	↓	8.31	849	↓	↓	KS
7	3.5	4.3	7	0	X			G13I07(F or L)	0730	10:30	7.76	800	167092	156500	KS
					X			G13I07(F or L)D	↓	↓	7.76	800	↓	↓	KS
						X		G13U07(F or L)	↓	↓	8.17	861	↓	↓	KS
							X	G13E07(F or L)	↓	↓	8.20	841	↓	↓	KS
8	3.5	7.2	7	0	X			G13I08(F or L)	10:45	13:45	7.75	883	167092	168720	MU
						X		G13U08(F or L)	↓	↓	7.82	938	↓	↓	MU

TREATABIL :STS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SAMPLE COLLECTION LOG

PUMPING WELL 4-13

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G13E08(F or L)	10:45	13:45	8.23	918	167092	168720	MU
9	3.5	21.6	7	0	X			G13I09(F or L)	1355	1655	7.37	930	169058	177300	[illegible]
						X		G13U09(F or L)		1655	7.45	790			[illegible]
							X	G13E09(F or L)		1655	7.60	777			[illegible]
10	1.5	4.3	5	0	UNTREATED X			G13I10(F or L)	1915	2215	8.02	768	2250 174805	2250 173500	[illegible]
						X		G13U10(F or L)		2215	7.64	819			[illegible]
							X	G13E10(F or L)		2215	8.23	810			[illegible]
11	1.5	7.2	5	0	X			G13I11 (F or L)	2245	0145	7.10	880	174805	204094	KS
						X		G13U11(F or L)		0145	6.60	947			KS
							X	G13E11(F or L)		0145	7.52	983			KS
12	1.5	21.6	5	0	X			G13I12(F or L)	0210	0510	7.50	1030	177492	213810	KS
						X		G13U12(F or L)			6.56	1020			KS
							X	G13E12(F or L)			8.20	960			KS
13	2.5	4.3	5	0	X			G13I13(F or L)	0530	0830	7.62	901	181022	222190	KS
						X		G13U13(F or L)			7.18	1030			KS
							X	G13E13(F or L)			8.18	962			KS
							X	G13E13(F or L)D			8.18	962			KS
14	2.5	7.2	5	0	X			G13I14(F or L)	0900	12:00	7.42	896	181022	235150	KS/[illegible]
						X		G13U14(F or L)			7.92	792			KS/[illegible]
							X	G13E14(F or L)			8.03	914			KS/[illegible]
15	2.5	21.6	5	0	X			G13I15(F or L)	1220	1520	7.13	967	185510	242998	[illegible]
						X		G13U15(F or L)		1520	6.22	830			[illegible]
							X	G13E15(F or L)		1520	7.52	820			[illegible]
16	3.5	4.3	5	0	X			G13I16(F or L)	1540	1840	7.22	857	187285	257305	[illegible]
						X		G13U16(F or L)	1540	1840	6.10	904			[illegible]

TREATABILI TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SAMPLE COLLECTION LOG

PUMPING WELL 4-13

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G13E16(F or L)	1540	1840	7.59	813	187285	253305	MY
17	3.5	7.2	5	0	X			G13I17(F or L)	1900	2200	7.34	804	187285	264960	MY
						X		G13U17(F or L)	↓	2200	6.86	882	↓	↓	MY
							X	G13E17(F or L)	↓	2200	7.64	810	↓	↓	MY
18	3.5	21.6	5	0	X			G13I18(F or L)	2210	0110	7.35	770	190003	271077	KS
						X		G13U18(F or L)	↓	↓	6.63	837	↓	↓	KS
							X	G13E18(F or L)	↓	↓	7.69	835	↓	↓	KS
19	1.5	4.3	9	0	X			G13I19(F or L)	0800	11:00	7.26	855	200050	297794	KS
						X		G13U19(F or L)	↓	↓	9.47	1839	↓	↓	KS
							X	G13E19(F or L)	↓	↓	8.02	786	↓	↓	KS
20	1.5	7.2	9	0	X			G13I20(F or L)	11:20	14:20	7.75	862	200050	311490	MY
						X		G13U20(F or L)	↓	↓	9.07	848	↓	↓	↓
						X		G13U20(F or L)D	↓	↓	9.09	851	↓	↓	↓
							X	G13E20(F or L)	↓	↓	8.03	893	↓	↓	↓
21	1.5	21.6	9	0	X			G13I21(F or L)	1435	1735	7.90	890	205705	319280	MY
						X		G13U21(F or L)	↓	↓	9.21	908	↓	↓	↓
							X	G13E21(F or L)	↓	↓	7.94	900	↓	↓	↓
22	2.5	4.3	9	0	X			G13I22(F or L)	1745	2045	7.68	860	205850	329520	[illegible]
						X		G13U22(F or L)	↓	2045	8.82	949	↓	↓	↓
							X	G13E22(F or L)	↓	2045	7.88	927	↓	↓	↓
23	2.5	7.2	9	0	X			G13I23(F or L)	2105	0005	7.79	918	205854	341486	MY/KS
						X		G13U23(F or L)	↓	0005	8.68	913	↓	↓	KS
							X	G13E23(F or L)	↓	0005	8.03	870	↓	↓	KS
24	2.5	21.6	9	0	X			G13I24(F or L)	0040	0240*	7.85	912	209400	351030	KS
						X		G13U24(F or L)	↓	↓	9.15	942	↓	↓	KS

* Sample actually collected 3 hrs after test started (daylight savings).

TREATABILI TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON

PUMPING WELL 4-13

SAMPLE COLLECTION LOG

* Test began on 11/1/93 @ 11:00

Test No.	Ozone (mg/L/min)	UV/ox Flow Rate (gpm)	pH	H2O2 (mg/L)	Influent (I)	Post UV/ox (U)	Post GAC (E)	Field Sample No.	Time Test Started	Time Sample Collected	Sample pH	Sample Cond	(TS) Totalizer Reading	(BP) Totalizer Reading	Sampler's Initials
							X	G13E24(F or L)	0040	0240	7.77	914	209400	351030	KS
25	3.5	4.3	9	0	X			G13I25(F or L)	0300	0600	7.80	936	212444	360165	KS
						X		G13U25(F or L)	↓	↓	8.74	1012	↓	↓	KS
							X	G13E25(F or L)	↓	↓	7.91	957	↓	↓	KS
26	3.5	7.2	9	0	X			G13I26(F or L)	11:00*	14:00	7.69	926	218228	469870	MM
						X		G13U26(F or L)	↓	↓	8.76	948	218228	↓	↓
							X	G13E26(F or L)	↓	↓	8.05	990	↓	↓	↓
27	3.5	21.6	9	0	X			G13I27(F or L)	1415	1715	7.91	897	↓	481630	↓
					X			G13I27(F or L)D	↓	1715	7.79	894	↓	↓	↓
						X		G13U27(F or L)	↓	1715	8.90	947	↓	↓	↓
							X	G13E27(F or L)	↓	1715	8.61	914	↓	↓	↓
28	3.5	4.3 wo/UV	7	1.2	X			G13I28(F or L)	1755	2055	7.72	860	224102	489320	MM
						X		G13U28(F or L)	↓	2055	8.15	945	↓	↓	MM
							X	G13E28(F or L)	↓	2055	7.83	933	↓	↓	MM
29	3.5	7.2 wo/UV	7	1.2	X			G13I29(F or L)	2120	0020	7.84	867	224102	[illegible]	KS
						X		G13U29(F or L)	↓	↓	8.14	882	↓	↓	KS
							X	G13E29(F or L)	↓	↓	7.89	903	↓	↓	KS
30	3.5	21.6 wo/UV	7	1.2	X			G13I30(F or L)	0050	0350	7.78	867	224102	513686	KS
						X		G13U30(F or L)	↓	↓	8.04	885	↓	↓	KS
							X	G13E30(F or L)	↓	↓	7.88	907	↓	↓	KS
31	3.5	4.3	7	0	X			G13I31(F or L)	1230	1530	7.68	917	229916	550675	MM
						X		G13U31(F or L)	↓	↓	8.26	878	229916	550675	↓
							X	G13E31(F or L)	↓	↓	7.78	906	229916	550675	↓
							X	G13E31(F or L)D	↓	↓	7.76	930	229916	550675	↓

File:TREAT13.XLS

F = Field Laboratroy Sample

L = Contract Laboratory Sample

D = Duplicate Sample Required

TS = Treatment System

BP = Bypass System

DAMES & MOORE

APPENDIX C:

System Settings Log

UV
C-2

TREATABI Y TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SYSTEM SETTINGS LOG

Ozone Doseage = $\frac{\text{air flow} \times O_3 \text{ conc} \times 2.}{650}$

PUMPING WELL No. 4-1

Test Number	Date/Time	Desired Ozone Doseage mg/L/min	Cell Pressure psi	Air Flow Rate scfh	Ozone Conc %	Actual Ozone Doseage mg/L/min	Desired UV/ox Flow Rate gpm	Actual UV/ox Flow Rate gpm	Desired pH	Actual pH	Desired H2O2 Conc mg/L	Actual H2O2 Conc mg/L
1	10-13/ 11 25	1.5	15	210	2.075	1.5	4.3	5.5 Adjusted 6"	7	7.6	0	NA
	10-13/ 12:20		15	208	2.042	1.5		3.8		7.7		NA
	10-13/ 13:20		15	210	2.026	1.5		4		7.8		NA
2	10-13/ 15:15	1.5	15	210	2.080	1.5	7.2	7.0	7	7.9	0	NA
	10-13/ 16:45		15	208	2.077	1.5		7.0		7.8		NA
	10-13/ 18:15		15	208	2.068	1.5		6.8		7.9		NA
3	10-13/ 18:35	1.5	15	210	2.075	1.5	21.6	21.2	7	7.9	0	NA
	10-13/ 20:05		15	210	2.112	1.6		21.5		7.7		NA
	10-13/ 21:25		15	208	2.120	1.6		21.2		7.9		NA
4	10-13/ 22:00	2.5	15	345	2.176	2.6	4.3	4.0	7	7.8	0	N/A
	10-13/ 23:30		15	345	2.146	2.6		4.0		7.8		N/A
	10-14/ 00:50		15	345	2.145	2.6		4.0		7.8		N/A
5	10-14/ 01:35	2.5	15	345	2.146	2.6	7.2	7.1	7	7.7	0	N/A
	10-14/ 03:05		15	345	2.150	2.6		6.7 Adjust 7.4		7.6		N/A
	10/14/ 0935		15	345	2.157	2.6		6.0 Adjust to 24		7.7		N/A
6	6/14/ 0755	2.5	15	345	2.153	2.6	21.6	21.5	7	7.6	0	N/A
	6/14/ 0625		15	345	2.160	2.6		30 Adj to 21.4		7.4		N/A
	6/14/ 0745		15	345	2.162	2.6		20.4		7.3		N/A
7	6/14/ 0815	3.5	15	480	2.131	3.7	4.3	4.4	7	7.5	0	N/A
	6/14/ 1040		15	490	2.190	3.4		4.0		7.7		N/A
	6/14/ 1105		15	490	1.977	3.4		4.3		7.6		N/A
8	6/15/ 0130	3.5	15	485	2.180	3.7	7.2	7.0	7	7.6	0	N/A
	6/15/ 0300		15	480	2.063	3.5		7.5		7.4		N/A
	6/15/ 0420		15	480	2.041	3.5		8.0 Adjust to 7.0		7.6		N/A
9	6/15/ 0500	3.5	15	480	2.070	3.5	21.6	21.4	7	7.5	0	N/A
	6/15/ 0630		15	480	2.072	3.5		20.8		7.3		N/A
	6/15/ 0750		15	480	2.072	3.5		21.4		7.4		N/A
10	6/15/ 1100	1.5	15	210	2.040	1.5	4.3	4.1	5	6.4	0	N/A
	6/15/ 1230		15	210	2.042	1.5		4.1		5.8		N/A
	6/15/ 13:25		15	210	2.015	1.5		4.0		6.0		N/A
11	6/15/ 14:30	1.5	15	210	1.976	1.5	7.2	7.0	5	5.8	0	N/A

UV
C-3

TREATABII / TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SYSTEM SETTINGS LOG

PUMPING WELL No. 4-1

Test Number	Date/Time	Desired Ozone Doseage mg/L/min	Cell Pressure psi	Air Flow Rate scfh	Ozone Conc %	Actual Ozone Doseage mg/L/min	Desired UV/ox Flow Rate gpm	Actual UV/ox Flow Rate gpm	Desired pH	Actual pH	Desired H2O2 Conc mg/L	Actual H2O2 Conc mg/L
11	10-15/ 16:00	1.5	15	210	1.993	1.5	7.2	7.5	5	5.5	0	N/A
	10-15/ 17:20		15	210	2.093	1.5		7.6		5.6		N/A
12	10-15/ 17:45	1.5	15	210	2.060	1.5	21.6	21.6	5	5.7	0	N/A
	10-15/ 19:15		—	—	—			—		—		N/A
	10-15/ 20:35		15	210	1.996	1.5		21.0		5.6		N/A
13	10-15/ 21:00	2.5	15	350	2.22	2.7	4.3 -	4.4	5	4.0	0	N/A
	10-15/ 22:30		15	350	2.086	2.6		4.4		4.8		N/A
	10-15/ 23:55		15	350	2.082	2.6		4.0		5.7		N/A
14	10/16/ 0105	2.5	15	345	2.077	2.5	7.2	7.4	5	5.7	0	N/A
	10/16 0235		15	350	2.080	2.6		7.2		5.40		NA
	10/16 0355		15	350	2.096	2.6		7.4		5.16		N/A
15	10/16 0435	2.5	15	350	2.105	2.6	21.6	21.5	5	4.53	0	N/A
	10/16 0535		15	350	2.116	2.6		20.7		4.38		N/A
	10/16 0625		15	350	2.116	2.6		21.0		4.20		N/A
16	10/16 0705	3.5	15	490	2.148	3.7	4.3	4.3	5	3.52	0	N/A
	10/16 0835		15	490	2.018	3.5		~~5.6~~ 4.7		5.6		N/A
	10/16 0955		15	480	1.995	3.4		5.0		5.7		N/A
17	10/16 1030	3.5	15	480	2.011	3.4	7.2	7.4	5	6.8	0	N/A
	10/16 1150		15	490	2.002	3.5		7.0		5.7		N/A
	10/16 1310		15	490	1.972	3.4		7.0		5.6		N/A
18	10/16 / 13:50	3.5	15	490	1.968	3.4	21.6	21.1	5	5.6	0	N/A
	10/16 / 14:50		15	490	1.955	3.4		21.0		5.6		N/A
	10/16 / 15:45		15	490	1.952	3.4		21.0		5.7		N/A
19	10/16 / 17:30	1.5	14.5	210	2.015	1.5	4.3	4.0	9	9.1	0	N/A
	10/16 / 19:00		15	212	2.065	1.5		4.4		9.3		N/A
	10/16 / 20:25		15	212	2.058	1.5		4.0		9.3		N/A
20	10/16 / 21:00	1.5	15	212	2.087	1.5	7.2	7.4	9	9.3	0	N/A
	10/16 / 22:30		15	212	2.080	1.6		7.2		9.3		N/A
	10/16 / 23:55		15	212	2.107	1.6		7.2		9.3		N/A
21	10/17 / 0050	1.5	15	210	2.113	1.6	21.6	21.4	9	9.3	0	N/A
	10/17 / 0130		15	212	2.080	1.5		21.0		9.4		N/A

UV
C-4

TREATA TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SYSTEM SETTINGS LOG

PUMPING WELL No. 4-1

Test Number	Date/Time	Desired Ozone Doseage mg/L/min	Cell Pressure psi	Air Flow Rate scfh	Ozone Conc %	Actual Ozone Doseage mg/L/min	Desired UV/ox Flow Rate gpm	Actual UV/ox Flow Rate gpm	Desired pH	Actual pH	Desired H2O2 Conc mg/L	Actual H2O2 Conc mg/L
	10/17 0340		15	212	2.036	1.5		21		9.5		NA
22	10/17 0430	2.5	15	345	2.160	2.6	4.3	4.2	9	9.4	0	
	10/17 0600		15	350	2.142	2.6		5.3		9.6		
	10/17 0720		15	345	2.136	2.6		4.6		9.3		
23	10/17 0845	2.5	15	345	2.081	2.5	7.2	7.2	9	9.08	0	
	10/17 0935		15	345	2.070	2.5		7.4		9.3		
	10/17 1055		15	345	2.057	2.5		7.4		9.3		
24	10/17 1135	2.5	15	345	2.057	2.5	21.6	21.0	9	9.1	0	
	10/17 1305		15	350	2.051	2.5		20.5		9.2		
	10/17 14:30		15	345	2.005	2.4		20.0		9.2		
25	10/17 15:05	3.5	15	490	2.001	3.5	4.3	4.4	9	9.2	0	
	10/17 16:40		15	490	1.893	3.3		4.1		9.5		
	10/17 17:55		15	490	1.966	3.4		4.1		9.3		
26	10/17 18:25	3.5	15	490	1.970	3.4	7.2	7.0	9	9.2	0	
	10/17 19:55		15	490	2.015	3.5		7.0		9.3		NA
	10/17 21:20		15	490	2.028	3.5		7.1		9.2		NA
27	10/17 21:50	3.5	15	490	2.033	3.5	21.6	21.0	9	9.2	0	NA
	10/17 23:20		15	490	2.053	3.5		21.0		9.1		NA
28	10/18 16:00	3.5	14.5	490	1.896	3.3	4.3 wo/UV	4.0	7	7.8	1.2	1.2
	10/18 17:30		15.0	500	1.911	3.3		4.0		7.7		N/A (1.2)
	10/18 18:55		15.0	500	1.901	3.4		4.4		7.7		1.2
29	10/18 19:15	3.5	15	490	1.843	3.2	7.2 wo/UV	7.0	7	7.7	1.2	1.2
	10/18 20:45		15	490	1.908	3.3		7.1		7.7		1.2
	10/18 22:10		15	496	1.910	3.3		7.0		7.8		1.2
30	10/18 22:45	3.5	15	490	1.916	3.3	21.6 wo/UV	21.0	7	7.7	1.2	1.2
	10/19 00:15		15	490	1.943	3.3		21.0		7.8		1.2
	10/19 01:35		15	490	1.932	3.3		20.0		7.9		1.2
31	10/19 0200	3.5	15	490	1.951	3.4	4.3	4.3	7	7.9	0	1.2
	10/19 0330		15	490	1.925	3.3		4.4		7.84		1.2
File: TC.XLS	10/19 0450		15	490	1.947	3.4		4.7		7.83		1.2

UV
C-5

TREATA TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SYSTEM SETTINGS LOG

OZONE DOSE = A.F. x OZONE CONC x 2.29 / 650

PUMPING WELL No. 4-13

Test Number	Date/Time	Desired Ozone Doseage mg/L/min	Cell Pressure psi	Air Flow Rate scfh	Ozone Conc % reading	Actual Ozone Doseage mg/L/min	Desired UV/ox Flow Rate gpm	Actual UV/ox Flow Rate gpm	Desired pH	Actual pH	Desired H2O2 Conc mg/L	Actual H2O2 Conc mg/L
1	10/27/93 1230	1.5	15	210	2.022	1.5	4.3	4.4	7	7.80	0	N/A
	10/27 1348		15	210	1.977	1.5		4.4		7.81		
	1500		15	210	2040	1.5		4.8		7.83		
2	1555	1.5	15	210	2.095	1.5	7.2	7.2	7	7.79	0	
	1710		15	210	2.006	1.5		7.2		7.73		
	1750		15	210	1.983	1.5		7.2		7.72		
3	START 1815 1920	1.5	15	210	2.023	1.5	21.6	20.4	7	7.87	0	
	2005		15	210	2.086	1.5		20.8		7.77		
	2105		15	210	1.961	1.5		21.0		7.76		
4	START 2130 2233	2.5	14.2	345	2.055	2.5	4.3	4.3	7	7.95	0	
	2349		14.2	345	2.062	2.5		4.1		7.73		
	0020		15.0	350	2.078	2.6		4.1		7.75		
5	0100	2.5	15.0	350	2.031	2.5	7.2	7.3	7	7.80	0	
	0230		15.0	345	2.042	2.5		7.0		7.85		
	0350		15.0	345	2.196	2.7		7.2		7.71		
6	0415	2.5	15.0	345	2.011	2.4	21.6	21.5	7	7.90	0	
	0545		15.0	345	2.046	2.5		21.8		7.86		
	0705		15.0	345	2.052	2.5		21.2		7.82		
7	0730	3.5	15.0	490	1.920	3.3	4.3	4.1	7	7.89	0	
	0900		15.0	490	1.942	3.4		4.1		7.84		
	1020		15.0	490	1.923	3.3		4.1		7.69		
8	1045	3.5	15.0	490	1.961	3.4	7.2	7.0	7	7.75	0	
	1206		15.0	490	2.032	3.5		7.0		8.09	PH PROBE CHANGED	
	1320		15.0	490	1.992	3.4		7.2		8.12		
9	START 1355 1415	3.5	15.0	490	2.012	3.5	21.6	21.6	7	7.94	0	
	1510		15.0	490	1.925	3.3		20.4		7.61		
	1620		15.0	490	1.985	3.4		20.0		7.49	ACID TREATED	
10	START 1915 2015	1.5	15.0	210	2.063	1.5	4.3	4.4	5	5.83	0	
	2105		15.0	210	2.041	1.5		4.3		6.00		
	2155		15.0	210	2.028	1.5		4.3		6.03		
11	STARTED 2215 2330	1.5	15.0	210	2.086	1.5	7.2	7.2	5	7.18	0	

UV
C-6

TREATA[illegible] TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SYSTEM SETTINGS LOG

PUMPING WELL No. 4-13

*after recalibration

Test Number	Date/Time	Desired Ozone Doseage mg/L/min	Cell Pressure psi	Air Flow Rate scfh	Ozone Conc %	Actual Ozone Doseage mg/L/min	Desired UV/ox Flow Rate gpm	Actual UV/ox Flow Rate gpm	Desired pH	Actual pH	Desired H2O2* Conc mg/L	Actual H2O2* Conc mg/L
	10-29/0015	1.5	15	210	2.097	1.6	7.2	7.0	5	4.92*		NA
	10-29/0135		15	210	2.136	1.6	7.2	7.4		5.05		
12	10-29/0210	1.5	15	210	2.121	1.6	21.6	21.8	5	5.76	0	
	10-29/03:40		15	210	2.110	1.6		20.5		5.42		
	10-29/05:00		15	210	2.093	1.5		21.5		5.50		
13	10-29/05:30	2.5	15	345	2.188	2.7	4.3	4.3	5	5.32	0	
	10-29/07:00		15	345	2.162	2.6		4.1		5.20		
	10-29/08:20		15	345	2.090	2.5		4.3		5.31		
14	10-29/09:00	2.5	15	345	2.138	2.6	7.2	7.3	5	5.54	0	
	10-29/10:30		15	345	2.157	2.6		7.0		5.65		
	10-29/11:50		15	345	2.110	2.6		7.0		5.56		
15	10-29/1300	2.5	15	345	2.057	2.5	21.6	20.0	5	5.49	0	
	1340		15	345	2.071	2.5		20.4		5.24		
	1450		15	345	2.056	2.5		21.6		5.07		
16	1635	3.5	15	490	1.887	3.3	4.3	4.4	5	5.22	0	
	1720		15	490	2.015	3.5		4.4		5.11		
	1820		15	490	2.041	3.5		4.4		5.21		
17	1900 1950	3.5	15	490	2.062	3.6	7.2	7.2	5	5.22	0	
	2015		15	490	2.003	3.5	NA	7.0		5.24		
	2130		15	490	1.871	3.2		7.2		5.22		
18	2300	3.5	15	490	2.035	3.5	21.6	21.6	5	5.35	0	
	10-29-93 2345		15	490	1.911	3.3		21.0		5.18		
	0100		15	490	1.958	3.4		21.2		5.10		
19	0800	1.5	15	210	1.995	1.5	4.3	4.1	9	9.37	0	
	0930		15	210	2.061	1.5		4.2		9.53		
	10:50		15	210	2.007	1.5		4.4		9.50		
20	11:20	1.5	15	210	2.130	1.6	7.2	7.2	9	9.41	0	
	1225		15	210	2.147	1.6		7.0		9.21		
	1325		15	210	2.053	1.5		7.0		9.15		
21	1500	1.5	15	210	1.927	1.4	21.6	21.2	9	9.55	0	
	1550		15	210	1.852	1.4		21.0		9.56		

UV
C-7

TREATA TESTS
SUPPLEMENTARY REMEDIAL INVESTIGATION/FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
SYSTEM SETTINGS LOG

PUMPING WELL No. 4-13

Test Number	Date/Time	Desired Ozone Doseage mg/L/min	Cell Pressure psi	Air Flow Rate scfh	Ozone Conc %	Actual Ozone Doseage mg/L/min	Desired UV/ox Flow Rate gpm	Actual UV/ox Flow Rate gpm	Desired pH	Actual pH	Desired H2O2 Conc mg/L	Actual H2O2 Conc mg/L
	10/30/93 1700		15	210	1.933	1.4		21.6	~~9.47~~	9.47		N/A
22	1810	2.5	15	345	1.947	2.4	4.3	4.4	9	9.43	0	
	1925		15	345	2.048	2.5		4.0		9.43		
	2015		15	345	2.022	2.5		4.4		9.48		
23	2125	2.5	15	345	2.082	2.5	7.2	7.2	9	9.26	0	
	2220		15	345	2.085	2.5		7.2		9.21		
	2330		15	345	2.045	2.5		7.0		9.25		
24	0040	2.5	15	345	2.048	2.5	21.6	21.5	9	9.25	0	
	0110		15	340	2.016	2.4		21.4		9.24		
	0230		15	340	2.028	2.4		21.4		9.48		
25	0300	3.5	15	490	1.998	3.5	4.3	4.3	9	9.44	0	
	0430		15	490	1.848	3.2		4.4		9.39		
	0550		15	490	2.040	3.5		4.1		9.41		
26	0620	3.5	15	490	1.848	3.2	7.2	7.3	9	9.39	0	
	0750		15	490	1.848	3.2		7.2		9.35		
	11/1/93 1325		15	490	1.998	3.3		7.2		9.41		
27	1450	3.5	15	490	1.903	3.3	21.6	21.6	9	9.32	0	
	1550		15	490	2.001	3.5		21.6		9.33		
	1630		15	490	1.997	3.3		21.6		9.33		
28	1815	3.5	15	490	1.902	3.3	4.3 wo/UV	4.0	7	7.80	1.2	1.2
	1930		15	490	1.877	3.3		4.4		7.78		
	2010		15	490	1.930	3.3		4.4		7.76		
29	2145	3.5	15	490	1.923	3.3	7.2 wo/UV	7.1	7	7.80	1.2	
	2245		15	490	1.977	3.3		7.1		7.82		
	2330		15	490	1.921	3.3		7.0		7.84		
30	0050	3.5	15	490	1.903	3.3	21.6 wo/UV	21.5	7	7.85	1.2	
	0220		15	490	2.001	3.5		21.3		7.82		
	0340		15	490	2.008	3.5		21.3		7.80		
31	1230	3.5	15	490	2.025	3.5	4.3	4.4	7	7.66	0	
	1345		15	490	2.007	3.5		4.3		7.72		
File: TC.XLS	1500		15	490	2.015	3.5		4.3		7.77		
26	11-1-93/ 11:00	3.5	15	495	1.443	3.4	7.2	7.0	9	9.43	0	NA
	11/1/93 1215	3.5	15	490	1.985	3.4	7.2	7.2	9	9.39	0	N/A

APPENDIX D:

Addendum to Method Development Report

CONTENTS

D.1 INTRODUCTION

The purpose of this addendum is to document modifications to the field method Standard Operation Procedure (SOP) for the determination of 2,4,6-trinitrotoluene (TNT) and Royal Demolition Explosive (RDX) in groundwater as presented in the Final Method Validation Report, Field Method for the Determination of TNT and RDX in Groundwater (Dames & Moore, 1993). This addendum is also intended to document the results of the field analysis of samples collected during the treatability test at Umatilla Depot Activity (UMDA), Hermiston, Oregon, and to provide an evaluation of method performance. The following sections present Quality Control (QC) data and analytical data from the field method as well as the observed difficulties and deficiencies encountered by the chemists during method implementation. Recommendations for further method development and modification are also presented.

D.2 FIELD IMPLEMENTATION OF FIELD METHOD

D.2.1 INSTRUMENT CALIBRATION

Instrument calibration was achieved and maintained following the procedure described in the SOP (Dames & Moore, 1993). This procedure included the evaluation of initial calibration standards and daily (i.e., continuing) calibration standards. Initial calibration standards were prepared from stock solution at concentrations of 100, 250, 500, 1000 and 5000 micrograms per liter (μg/L) for both TNT and RDX. Since the analytical methods for TNT and RDX resulted in a 20-fold concentration, the lowest possible quantitation limit was 5 μg/L. As a check against instrument stability, daily calibration standards were prepared and evaluated daily. The Quality Assurance/Quality Control (QA/QC) results from the initial and daily calibrations are presented in Section D.2.2 and worksheets are presented in Section D.5. The daily analysis logs are presented in Section D.6.

D.2.2 QUALITY CONTROL DATA

Method performance was carefully monitored by evaluating instrument linearity and stability and analytical precision and accuracy. The QA/QC program established for accomplishing this task is presented in the SOP. This program consisted of the following goals:

- Initial Calibration - performed as needed with correlation coefficient greater than 0.995.
- Daily Calibration - performed at least daily with percent difference (%D) between + or -10 percent.
- Method Blank - performed at least daily with results less than the detection limit.
- Blank Spike - performed at least daily with percent recovery (%R) between 90 and 110 percent.

- Sample Duplicate - performed at least daily with relative percent difference (RPD) less than 25 percent.
- Matrix Spike - performed daily with %R between 75 and 125 percent.

As a result of practical constraints realized during field operations it was necessary to deviate slightly from the QA/QC program presented in the SOP. Instead of choosing a matrix spike sample having a detectable concentration of TNT and RDX less than 1000 $\mu g/L$, the matrix spike sample was chosen randomly with some samples having non-detectable concentrations of TNT and RDX with others having concentrations exceeding 1000 $\mu g/L$. This variance was determined to be necessary to minimize the number of sample "re-runs" (i.e., from nondetections or excess concentrations of TNT and/or RDX), thereby allowing the chemists to better keep up with the sample train and to help speed up sample turnaround time.

The QA/QC program performance is presented in tabular form (Table D.2.2-1) and in the form of control charts (Figures D.2.2-1 through D.2.2-4). The daily analysis log and calculation worksheets are presented in Sections D.5 through D.8. Chain-of-custody forms and field laboratory notes are presented in Sections D.9 and D.10, respectively.

Initial calibrations (Section D.5) used for TNT determination were performed on October 11 and 27, 1993, and for RDX determination on October 13 and 27, 1993. Correlation coefficients for TNT were 0.9999 and 0.9995, respectively, with response factors of 4.75E-5 and 4.28E-5, respectively. Correlation coefficients for RDX were 0.9990 and 0.9967, respectively, with response factors of 3.59E-5 and 3.04E-5, respectively.

Daily calibration checks were typically performed twice per day from October 12 through November 3. These dates correspond to the beginning and ending of the field analysis schedule for the treatability test. The performance for both TNT and RDX was poor between October 12 and October 19. The %D for TNT was outside of the QC limits all 14 times and for RDX was only within the QC limits 3 out of 13

TABLE D.2.2-1
FIELD ANALYSIS FOR TNT AND RDX
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
Control Chart Data
File Name CCD.XLS

Daily Calibration Check (%D)			Blank Spikes Recoveries (%R)				Sample Duplicates (RPD)				Matrix Spikes Recoveries (%R)			
Date	TNT	RDX	Date	TNT	RDX		Date	TNT	RDX		Date	TNT	RDX	
12-Oct	-15		13-Oct	74	158		13-Oct				13-Oct			
13-Oct	-19	-33	14-Oct	41	187		14-Oct	6	27		14-Oct	105	0	NR/RDX
14-Oct	-11	-33	15-Oct	76	57		15-Oct				15-Oct			
14-Oct	-28	-16	16-Oct	106	106		16-Oct		103	ND/TNT	16-Oct	57	200	2267/RDX
14-Oct	-19	-44	17-Oct	80	82		17-Oct	31		ND/RDX	17-Oct	200	0	213/TNT - NR/RDX
15-Oct	-40	-21	18-Oct	72	200	211/RDX	18-Oct	48	42		18-Oct	0	0	NR/TNT - NR/RDX
15-Oct	-11	-89	19-Oct	86	59		28-Oct		81	ND/TNT	28-Oct	57	80	
16-Oct	-11	-2	28-Oct	88	98		29-Oct	22	15		29-Oct	85	200	787/RDX
16-Oct	-36	-10	29-Oct	77	200	329/RDX	30-Oct		54	ND/TNT	30-Oct	73	185	
17-Oct	-28	-21	30-Oct	81	178		31-Oct	17	110	799/RDX	31-Oct	87	32	
17-Oct	-15	-5	31-Oct	73	87		2-Nov	67		ND/RDX	2-Nov	19	33	
17-Oct	11	-61	2-Nov	118	86		2-Nov		104		2-Nov		200	8224/RDX
18-Oct	-15	-61	3-Nov	72	142		3-Nov		14	ND/TNT	3-Nov	49	48	
19-Oct	-32	-61												
28-Oct	7	16												
28-Oct	2	35												
29-Oct	-2	-39												
29-Oct	-12	23												
29-Oct	16	-7												
30-Oct	2	-69												
30-Oct	16	4												
31-Oct	2	-2												
31-Oct	-2	-39												

TABLE D.2.2-1
FIELD ANALYSIS FOR TNT AND RDX
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
Control Chart Data

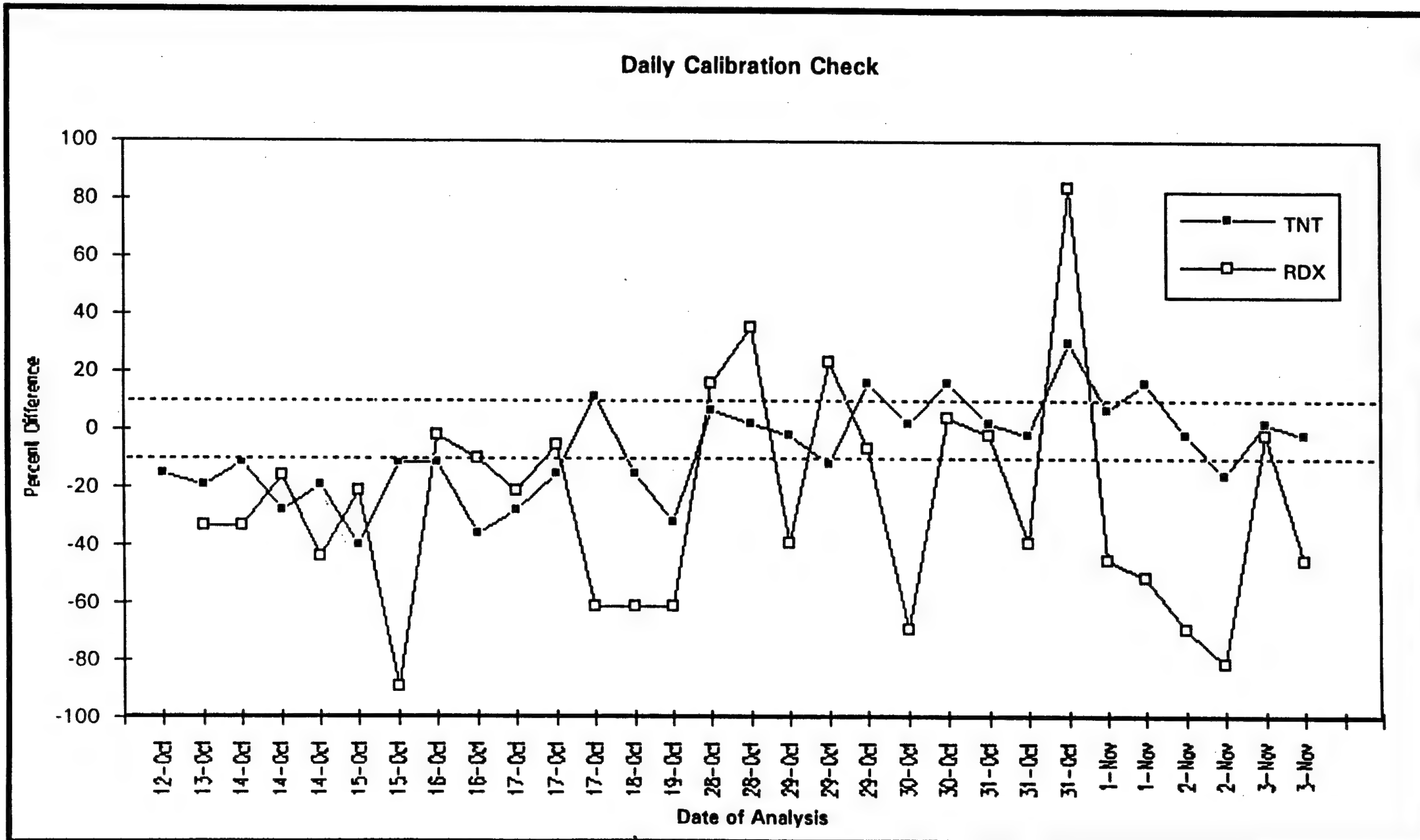
File Name CCD.XLS

Daily Calibration Check (%D)			Blank Spikes Recoveries (%R)			Sample Duplicates (RPD)			Matrix Spikes Recoveries (%R)		
Date	TNT	RDX	Date	TNT	RDX	Date	TNT	RDX	Date	TNT	RDX
31-Oct	30	84									
1-Nov	7	-45									
1-Nov	16	-51									
2-Nov	-2	-69									
2-Nov	-16	-81									
3-Nov	2	-2									
3-Nov	-2	-45									

NR - Spike Not Recovered

ND - Not Detected

Figure D.2.2-1



Daily Calibration Check
100
80
60
40
20
0
-20
-40
-60
-80
-100
Percent Difference
TNT
RDX
12-Oct
13-Oct
14-Oct
14-Oct
14-Oct
15-Oct
15-Oct
16-Oct
16-Oct
17-Oct
17-Oct
17-Oct
18-Oct
19-Oct
28-Oct
28-Oct
29-Oct
29-Oct
29-Oct
30-Oct
30-Oct
31-Oct
31-Oct
31-Oct
1-Nov
1-Nov
2-Nov
2-Nov
3-Nov
3-Nov
Date of Analysis

Figure D.2.2-2

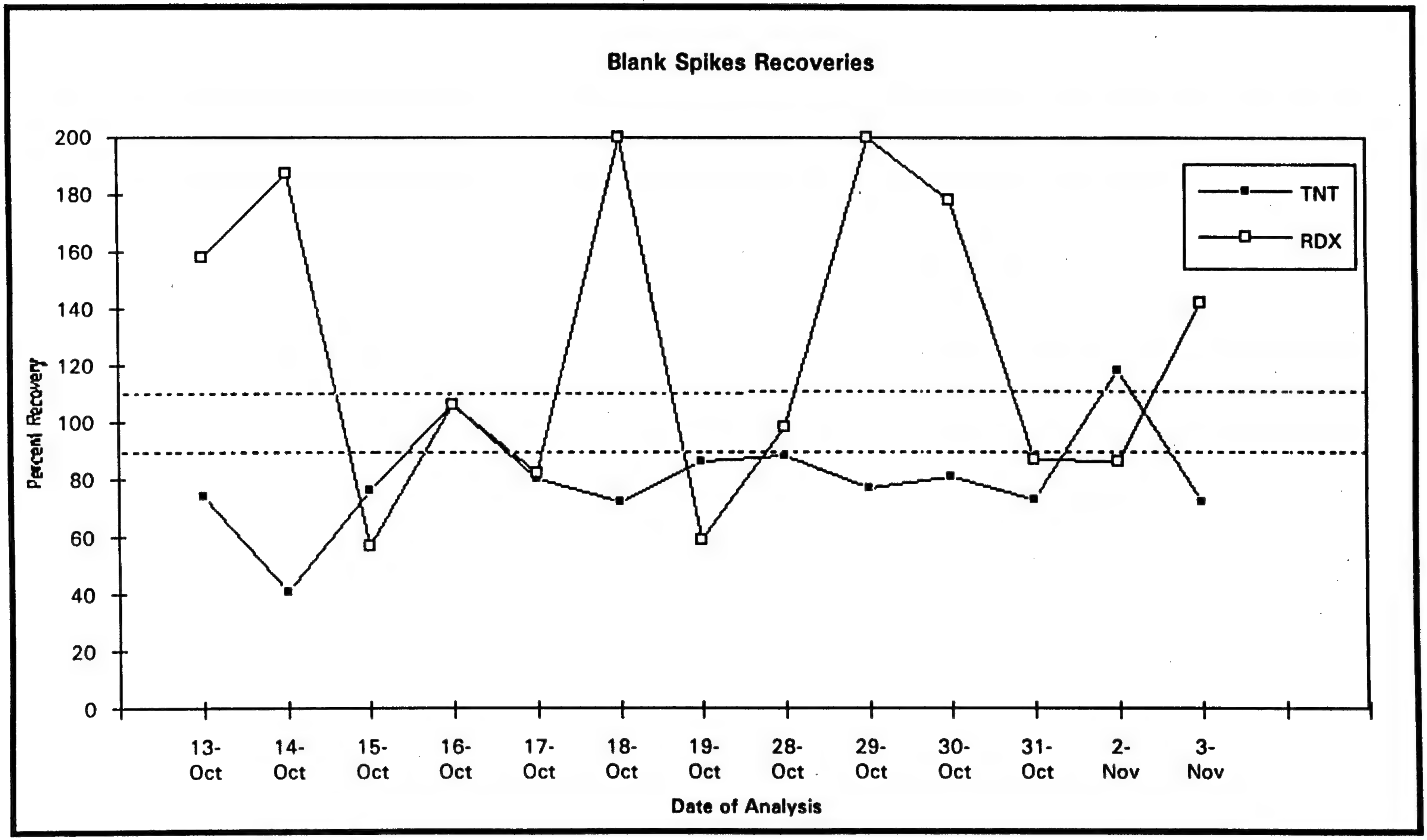

Blank Spikes Recoveries
TNT
RDX
Percent Recovery
200
180
160
140
120
100
80
60
40
20
0
13-Oct
14-Oct
15-Oct
16-Oct
17-Oct
18-Oct
19-Oct
28-Oct
29-Oct
30-Oct
31-Oct
2-Nov
3-Nov
Date of Analysis

Figure D.2.2-3

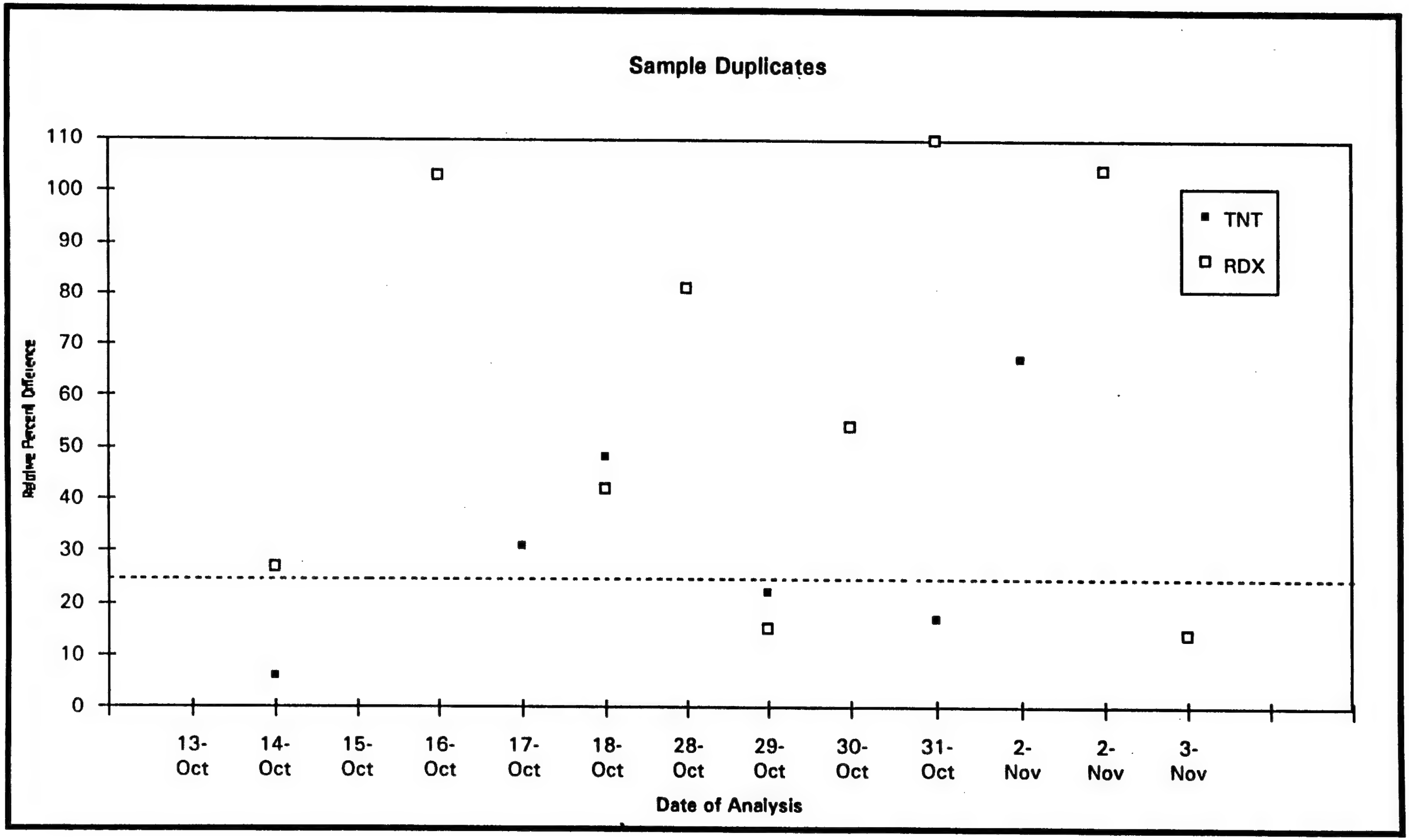
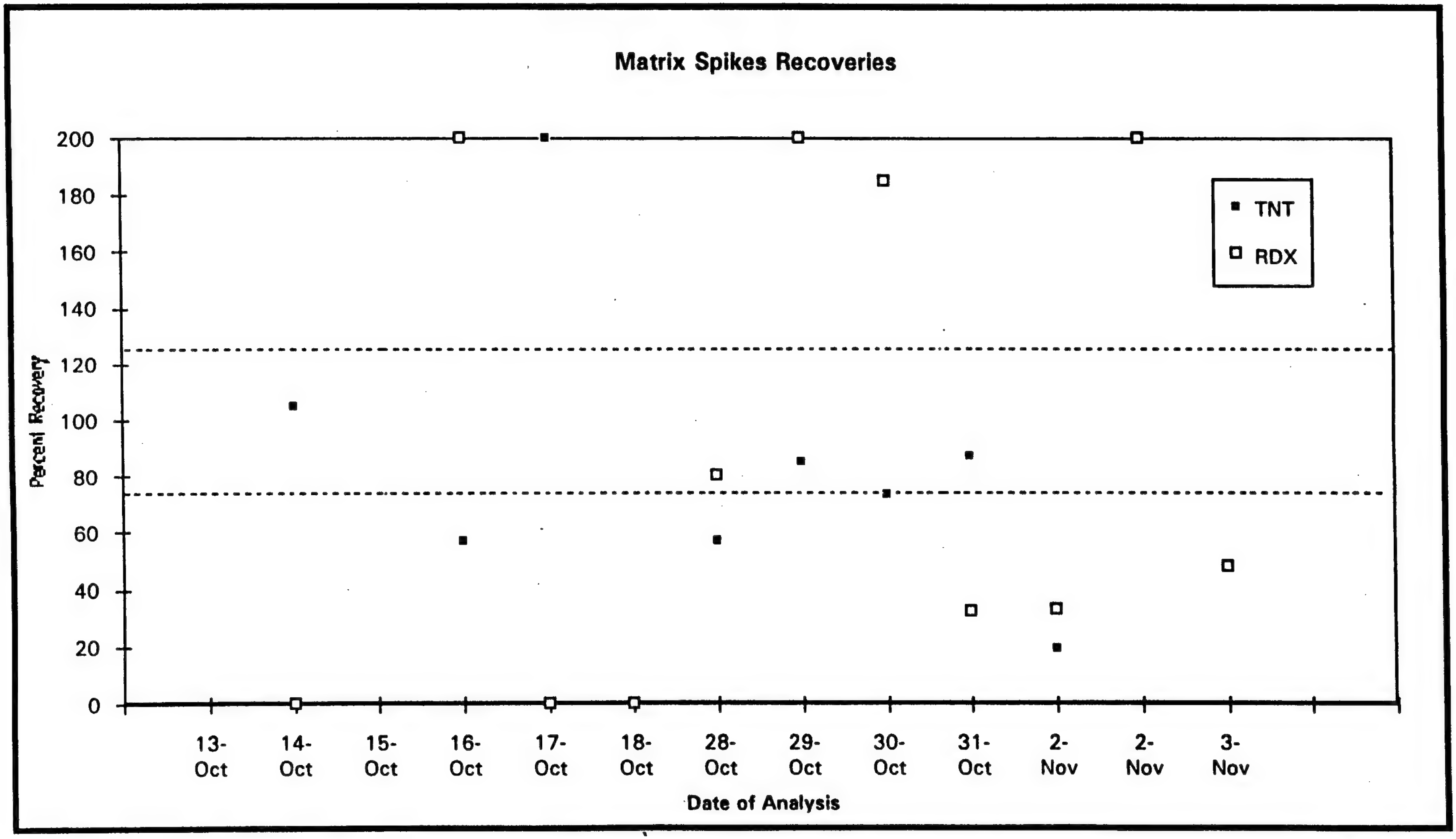

Sample Duplicates
Relative Percent Difference
110
100
90
80
70
60
50
40
30
20
10
0
13-Oct
14-Oct
15-Oct
16-Oct
17-Oct
18-Oct
28-Oct
29-Oct
30-Oct
31-Oct
2-Nov
2-Nov
3-Nov
Date of Analysis
TNT
RDX

Figure D.2.2-4


Matrix Spikes Recoveries
Percent Recovery
200
180
160
140
120
100
80
60
40
20
0
TNT
RDX
13- Oct
14- Oct
15- Oct
16- Oct
17- Oct
18- Oct
28- Oct
29- Oct
30- Oct
31- Oct
2- Nov
2- Nov
3- Nov
Date of Analysis

times. The %D fell below the lower limit of -10 with near consistency between these dates. Upon resumption of the field program on October 28, the %D for TNT improved remarkably while RDX appeared to worsen. The %D for TNT was within the QC limits 10 out of 16 times and for RDX was only within the QC limits 4 out of 16 times. The out-of-limit values were for the most part above the +10 limit for TNT and below the -10 limit for RDX. According to the SOP, corrective action required the re-analysis of the initial calibration standards. This was initially attempted but did not result in an improvement in daily calibration QC values. Based on this result, it appeared that the problem did not result from instrument stability but possibly from deficiencies with the analytical method (e.g., with color development). This assumption appears to be further supported by the results of blank spike and sample duplicate evaluations.

Method Blanks were performed at least daily. Results were consistently less than the detection limit and within QC limits.

Blank spikes were analyzed once per day with one exception. The blank spike was inadvertantly neglected on November 1. The percent recoveries for TNT fell below the 90 percent QC limit in nearly all samples. For a significant number of samples the %R for TNT tended to fall close to an average value of 80 percent. The %R for RDX fell equally below and above the QC limits and in a number of samples was greater than 160 percent.

Sample duplicates were initially analyzed at a frequency of five percent. After realizing that this was not corresponding to one duplicate sample per day, the frequency was changed from a percentage basis to a daily basis. In total, sample duplicates were neglected on four dates--October 13, 15, and 19, and November 3. RPDs for TNT were within the QC limit of 25 percent on three occasions while outside of the QC limit on three occasions. On four occasions the duplicate samples contained non-detectable concentrations of TNT preventing a duplicate comparison. The average RPD for TNT was 32 percent. RPDs for RDX were within the QC limit of 25 percent on two occasions while outside of the QC limit on seven occasions. On two occasions the

duplicate samples contained non-detectable concentrations of RDX. On one occasion (October 31) the RPD for the RDX duplicate was 799. For graphical considerations, this data point is shown in Figure D.2.2-3 as lying on the maximum scaling point of 110. Not using this extreme outlier (i.e., 799 RPD), the average RPD for RDX is 55.

As with sample duplicates, matrix spike recoveries were initially analyzed at a frequency of five percent. After realizing that this was not corresponding to one matrix spike sample per day, the frequency was changed from a percentage basis to a daily basis. In total, matrix spike samples were neglected on four dates--October 13, 15, and 19, and November 3. The %R for TNT fell within the QC limit of 75 to 125 percent on three occasions and outside of the QC limit on seven occasions. For a significant number of samples the %R for TNT tended to fall close to an average value of 75 percent. The %R for RDX fell equally below and above the QC limits and in a number of samples was greater than 180 percent and less than 40 percent. On three occasions, the %R for RDX were extremely high with values of 2267, 787, and 8224.

D.2.3 IMPLEMENTATION AND OPERATION OF THE FIELD ANALYTICAL METHOD

The SOP for the field method (Dames & Moore, 1993) was adhered to as closely as possible during the field program. TNT and RDX were extracted from groundwater samples by passing through a Heyesep R™ solid phase extraction (SPE) cartridge purchased from Supelco Inc. (Bellefonte, PA). These SPE cartridges were special ordered with 1 gram Heyesep R™ placed in a 3 mL tube and precleaned by the manufacturer (i.e., Supelco Inc.). After color development, absorption was measured using an AC-powered, dual-beam spectrometer (Hitachi U2000). To facilitate sample analysis, a multiple extraction manifold (Supelco Visiprep DL Vacuum Manifold) was used for the extraction of multiple samples.

Several minor modifications to the SOP were determined to be necessary to maintain efficiency and/or to improve method performance. Section D.3 presents the SOP which has been revised to reflect the specific procedure used during the field program. The "minor" modifications included: standard concentrations, zero absorption

determination, color development incubation times, and blank spike and matrix spike preparation.

D.2.4 COMPARISON OF CONTRACT LABORATORY DATA TO FIELD LABORATORY DATA

A comparison of the contract laboratory data (using an HPLC method based on USATHAMA method UW21) to the field laboratory data is presented in Table D.2.5-1 and Figures D.2.5-1 through D.2.5-3. The %D was calculated for samples having a positive detection by both the contract laboratory and the field laboratory.

The %D for the TNT data for well 4-1 tended to range between 5 and -200 with two extreme outlyers of -870 and -1025. In the majority of the samples, the field laboratory concentration was greater than the contract laboratory concentration. The average RPD of the contract laboratory data to the field laboratory data for TNT was 105 with a standard deviation of 2.03. Although low concentrations of TNT were detected by the field laboratory for well 4-13, this analyte was not detected by the contract laboratory.

The %D for the RDX data for well 4-1 tended to range between 80 and -100 with two extreme outlyers of -775 and -4861. The average RPD of the contract laboratory data to the field laboratory data for TNT was 167 with a standard deviation of 7.25. The %D for the RDX data for well 4-13 tended to range between 50 and -350 with three extreme outlyers of -754, −804 and -979. The average RPD of the contract laboratory data to the field laboratory data for TNT was 208 with a standard deviation of 2.36.

Based on this comparison of the contract laboratory data to the field laboratory data, the field method performance appears to be better for TNT than for RDX. However, the comparison of data also indicates that the field method tends to produce false positive results, particularly in the case of TNT. On average, the field method for both TNT and RDX appear to vary from contract laboratory data by a factor of two or more.

TABLE D.2.5-1
COMPARISON OF FIELD LABORATORY AND CONTRACT LABORATORY RESULTS
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
File Name TD25-1b.XLS

Sample I.D.	2,4,6-TNT Field Laboratory (ug/L)	2,4,6-TNT Contract Laboratory (ug/L)	% Difference	RDX Field Laboratory (ug/L)	RDX Contract Laboratory (ug/L)	% Difference
Well 4-1						
G01I00	3900	2900	-34%	2560	2600	2%
G01I01	3190	3200	0%	2480	2900	14%
G01U01	45	0.635U		85	1.17U	
G01E01	5U	0.635U		5U	1.17U	
G01I02	3340	3200	-4%	4090	2900	-41%
G01U02	146	0.635U		5	1.17U	
G01E02	5U	0.635U		440	1.17U	
G01I03	3200	330	-870%	3880	2900	-34%
G01U03	304	180	-69%	74	39.4	-88%
G01E03	.5U	0.635U		88	1.17U	
G01I04	3430	3300	-4%	1950	3000	35%
G01U04	6	0.635U		5U	1.17U	
G01E04	5U	0.635U		5U	1.17U	
G01I05	3550	3300	-8%	1820	3600	49%
G01U05	28	0.635U		5U	1.17U	
G01E05	5U	0.635U		5U	1.17U	
G01I06	3400	3100	-10%	3070	2700	-14%
G01U06	203	59.8	-239%	22	10.8	-104%
G01E06	5U	0.635U		22	1.17U	
G01I07	3060	3100	1%	2475	3200	23%
G01I07D	3250	3200	-2%	1880	3400	45%
G01U07	5U	0.635U		5U	1.17U	
G01E07	5U	0.635U		30	1.17U	
G01I08	3640	3200	-14%	2270	3400	33%
G01U08	46	0.635U		5U	1.17U	
G01E08	5U	0.635U		5	1.17U	
G01I09	3220	3200	-1%	2840	3400	16%
G01U09	117	39.7	-195%	7	7.3	4%
G01E09	5U	0.635U		5U	1.17U	
G01I10	3670	3600	-2%	674	3400	80%
G01U10	33	0.635U		5U	1.17U	
G01E10	5U	0.635U		5U	1.17U	
G01I11	3480	3000	-16%	3370	3000	-12%
G01U11	6	0.635U		5U	1.17U	
G01E11	5U	0.635U		5U	1.17U	
G01I12	3130	3200	2%	1160	3300	65%
G01U12	161	97.8	-65%	27	17.4	-55%
G01E12	5U	0.635U		5U	1.17U	
G01I13	3040	3200	5%	907	3300	73%
G01U13	38	0.635U		5U	1.17U	
G01E13	5U	0.635U		35	1.17U	
G01E13D	5U	0.635U		11	1.17U	

TABLE D.2.5-1
COMPARISON OF FIELD LABORATORY AND CONTRACT LABORATORY RESULTS
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
File Name TD25-1b.XLS

Sample I.D.	2,4,6-TNT Field Laboratory (ug/L)	2,4,6-TNT Contract Laboratory (ug/L)	% Difference	RDX Field Laboratory (ug/L)	RDX Contract Laboratory (ug/L)	% Difference
G01I14	4470	3100	-44%	1800	3300	45%
G01U14	5U	0.635U		5U	1.17U	
G01E14	5U	0.635U		11	1.17U	
G01I15	3720	3200	-16%	1240	3200	61%
G01U15	69	29.3	-135%	9	5.23	-72%
G01E15	5U	0.635U		29	1.17U	
G01I16	4510	3100	-45%	3500	2900	-21%
G01U16	5U	0.635U		5U	1.17U	
G01E16	5U	0.635U		5U	1.17U	
G01I17	4240	3100	-37%	2480	2900	14%
G01U17	5U	0.635U		18	1.17U	
G01E17	5U	0.635U		11	1.17U	
G01I18	3870	1100	-252%	1520	1300	-17%
G01U18	61	5.42	-1025%	64	1.29	-4861%
G01E18	5U	0.635U		1170	1.17U	
G01I19	2990	1800	-66%	2520	1900	-33%
G01U19	76	0.635U		11	1.17U	
G01E19	5U	0.635U		310	1.17U	
G01I20	4330	1900	-128%	3870	2000	-94%
G01U20	68	0.635U		16	1.17U	
G01U20D	94	0.635U		5U	1.17U	
G01E20	5U	0.635U		5U	1.17U	
G01I21	3950	930	-325%	1920	1200	-60%
G01U21	319	130	-145%	29	23.5	-23%
G01E21	5U	0.635U		6	1.17U	
G01I22	3350	1600	-109%	2590	1900	-36%
G01U22	36	0.635U		9	1.17U	
G01E22	5U	0.635U		529	1.17U	
G01I23	2450	2000	-23%	1660	2100	21%
G01U23	40	0.635U		9	1.17U	
G01E23	5U	0.635U		6	1.17U	
G01I24	3020	3100	3%	1840	2900	37%
G01U24	126	63.6	-98%	18	10.4	-73%
G01E24	5U	0.635U		53	1.17U	
G01I25	4650	2000	-133%	2180	2000	-9%
G01U25	9	0.635U		9	1.17U	
G01E25	5U	0.635U		10	1.17U	
G01I26	6100	1600	-281%	4490	1900	-136%
G01U26	28	0.635U		13	1.17U	
G01E26	5U	0.635U		108	1.17U	
G01I27	3480	3100	-12%	5600	3100	-81%
G01I27D	3170	3100	-2%	4310	3000	-44%
G01U27	49	14.4	-240%	23	2.63	-775%

TABLE D.2.5-1
COMPARISON OF FIELD LABORATORY AND CONTRACT LABORATORY RESULTS
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON

File Name TD25-1b.XLS

Sample I.D.	2,4,6-TNT Field Laboratory (ug/L)	2,4,6-TNT Contract Laboratory (ug/L)	% Difference	RDX Field Laboratory (ug/L)	RDX Contract Laboratory (ug/L)	% Difference
G01E27	5U	0.635U		16	1.17U	
G01I28	5600	3300	-70%	1860	3200	42%
G01U28	280	330	15%	121	820	85%
G01E28	5U	0.635U		5U	1.17U	
G01I29	4080	3300	-24%	1690	3200	47%
G01U29	309	350	12%	118	880	87%
G01E29	5U	0.635U		7	1.17U	
G01I30	3650	3200	-14%	1840	3000	39%
G01U30	814	720	-13%	166	1400	88%
G01E30	5U	0.635U		5U	1.17U	
G01I31	2930	3100	5%	2630	2900	9%
G01U31	202	0.635U		5U	1.17U	
G01E31	5U	0.635U		10	1.17U	
G01E31D	5U	0.635U		5U	1.17U	
AVERAGE RELATIVE % DIFFERENCE (Well 4-1) =			105%			167%
STANDARD DEVIATION (Well 4-1) =			2.03			7.25

U = The material was analyzed for but was not detected above the associated value.

TABLE D.2.5-1
COMPARISON OF FIELD LABORATORY AND CONTRACT LABORATORY RESULTS
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
File Name TD25-1b.XLS

Sample I.D.	2,4,6-TNT Field Laboratory (ug/L)	2,4,6-TNT Contract Laboratory (ug/L)	% Difference	RDX Field Laboratory (ug/L)	RDX Contract Laboratory (ug/L)	% Difference
Well 4-13						
G13I00	40	0.635U		3950	2300	-72%
G13I01	24	0.635U		565	2400	76%
G13U01	17	0.635U		5U	1.17U	
G13E01	5U	0.635U		5U	1.17U	
G13I02	91	0.635U		4980	1200	-315%
G13U02	7	0.635U		5U	1.17U	
G13E02	5U	0.635U		5U	1.17U	
G13I03	68	0.635U		2730	2300	-19%
G13U03	40	0.635U		5U	1.17U	
G13E03	5U	0.635U		51	1.17U	
G13I04	19	0.635U		2690	2200	-22%
G13U04	5U	0.635U		5U	1.17U	
G13E04	5U	0.635U		24	1.17U	
G13I05	19	0.635U		2470	2300	-7%
G13U05	12	0.635U		5U	1.17U	
G13E05	5U	0.635U		5U	1.17U	
G13I06	24	0.635U		1040	2200	53%
G13U06	24	0.635U		8	1.17U	
G13E06	5U	0.635U		5U	1.17U	
G13I07	26	0.635U		1720	1900	9%
G13I07D	21	0.635U		1990	2300	13%
G13U07	5U	0.635U		5U	1.17U	
G13E07	5U	0.635U		1430	1.17U	
G13I08	12	0.635U		1200	2400	50%
G13U08	5U	0.635U		5U	1.17U	
G13E08	5U	0.635U		11	1.17U	
G13I09	20	0.635U		3250	2400	-35%
G13U09	15	0.635U		5	12U	
G13E09	5U	0.635U		11	1.17U	
G13I10	20	0.635U		4810	2300	-109%
G13U10	5U	0.635U		11	1.17U	
G13E10	5U	0.635U		58	1.17U	
G13I11	18	0.635U		7440	2400	-210%
G13U11	5U	0.635U		8	1.17U	
G13E11	5U	0.635U		5U	1.17U	
G13I12	9	0.635U		7098	2300	-209%
G13U12	8	0.635U		5U	1.17U	
G13E12	5U	0.635U		5U	1.17U	
G13I13	16	0.635U		5930	2100	-182%
G13U13	5U	0.635U		8	1.17U	
G13E13	5U	0.635U		11	1.17U	
G13E13D	5U	0.635U		6	1.17U	

TABLE D.2.5-1
COMPARISON OF FIELD LABORATORY AND CONTRACT LABORATORY RESULTS
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
File Name TD25-1b.XLS

Sample I.D.	2,4,6-TNT Field Laboratory (ug/L)	2,4,6-TNT Contract Laboratory (ug/L)	% Difference	RDX Field Laboratory (ug/L)	RDX Contract Laboratory (ug/L)	% Difference
G13I14	20	0.635U		5640	2300	-145%
G13U14	5U	0.635U		7	1.17U	
G13E14	5U	0.635U		278	1.17U	
G13I15	27	0.635U		7110	2300	-209%
G13U15	7	0.635U		17	1.17U	
G13E15	5U	0.635U		8	1.17U	
G13I16	23	0.635U		8590	950	-804%
G13U16	5U	0.635U		178	1.17U	
G13E16	5U	0.635U		27	1.17U	
G13I17	19	0.635U		9460	2300	-311%
G13U17	5U	0.635U		3750	1.17U	
G13E17	5U	0.635U		27	1.17U	
G13I18	24	0.635U		9570	2300	-316%
G13U18	5U	0.635U		56	1.17U	
G13E18	5U	0.635U		13	1.17U	
G13I19	24	3.2U		11100	1300	-754%
G13U19	18	0.635U		32	1.17U	
G13E19	5U	0.635U		13	1.17U	
G13I20	43	3.2U		1270	2300	45%
G13U20	23	0.635U		5U	1.17U	
G13U20D	19	0.635U		5U	1.17U	
G13E20	5U	0.635U		13	1.17U	
G13I21	22	3.2U		3180	2300	-38%
G13U21	59	0.635U		5U	1.17U	
G13E21	5U	0.635U		5U	1.17U	
G13I22	17	3.2U		11700	2500	-368%
G13U22	5U	0.635U		5U	1.17U	
G13E22	5U	0.635U		5U	1.17U	
G13I23	9	3.2U		15100	1400	-979%
G13U23	11	0.635U		5U	1.17U	
G13E23	5U	0.635U		27	1.17U	
G13I24	5U	3.2U		4510	1300	-247%
G13U24	75	0.635U		5U	1.17U	
G13E24	5U	0.635U		5U	1.17U	
G13I25	5U	3.2U		4710	2000	-136%
G13U25	7	0.635U		5U	1.17U	
G13E25	5U	0.635U		16	1.17U	
G13I26	14	3.2U		5690	2100	-171%
G13U26	13	0.635U		5U	1.17U	
G13E26	5U	0.635U		5U	1.17U	
G13I27	29	3.2U		7300	2100	-248%
G13I27D	14	3.2U		2300	2900	21%
G13U27	100	0.635U		89	1.17U	

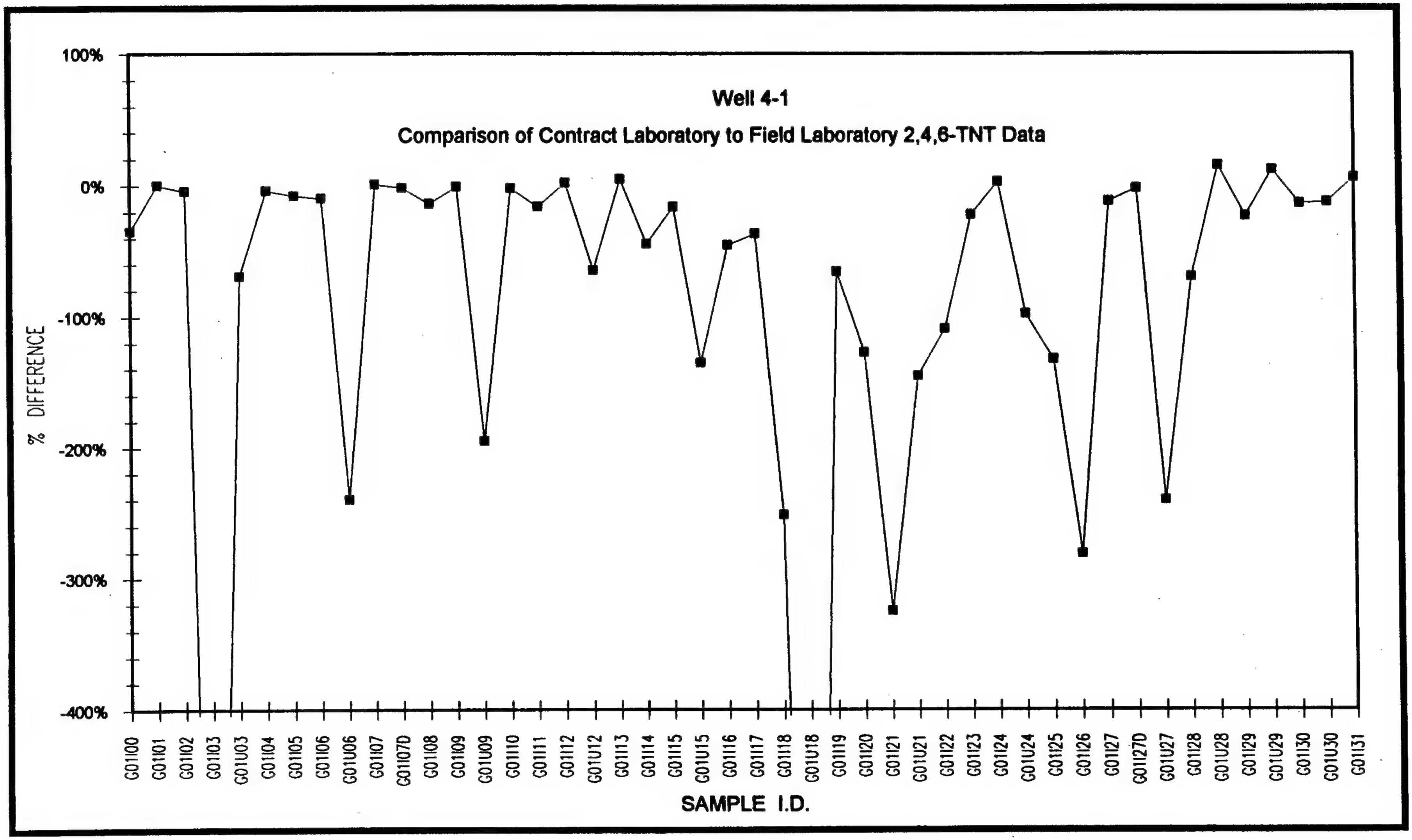
TABLE D.2.5-1
COMPARISON OF FIELD LABORATORY AND CONTRACT LABORATORY RESULTS
SUPPLEMENTARY REMEDIAL INVESTIGATION / FEASIBILITY STUDY
UMATILLA DEPOT ACTIVITY, HERMISTON, OREGON
File Name TD25-1b.XLS

Sample I.D.	2,4,6-TNT Field Laboratory (ug/L)	2,4,6-TNT Contract Laboratory (ug/L)	% Difference	RDX Field Laboratory (ug/L)	RDX Contract Laboratory (ug/L)	% Difference
G13E27	5U	0.635U		18	1.17U	
G13I28	167	3.2U		3910	1900	-106%
G13U28	5U	0.635U		97	33.9	-186%
G13E28	5U	0.635U		8	1.17U	
G13I29	64	3.2U		8960	2000	-348%
G13U29	19	0.635U		297	74.9	-297%
G13E29	5U	0.635U		15	1.17U	
G13I30	14	3.2U		7790	2500	-212%
G13U30	5U	0.635U		1320	340	-288%
G13E30	5U	0.635U		13	1.17U	
G13I31	10	3.2U		3830	2000	-92%
G13U31	5U	0.635U		5	1.17U	
G13E31	5U	0.635U		13	1.17U	
G13E31D	5U	0.635U		12	1.17U	

AVERAGE RELATIVE % DIFFERENCE (Well 4-13) =	105%	208%
STANDARD DEVIATION (Well 4-13) =	NA	2.36

U = The material was analyzed for but was not detected above the associated value.

Figure D.2.5-1



Well 4-1
Comparison of Contract Laboratory to Field Laboratory 2,4,6-TNT Data
100%
0%
-100%
-200%
-300%
-400%
% DIFFERENCE
G01I00
G01I01
G01I02
G01I03
G01U03
G01I04
G01I05
G01I06
G01U06
G01I07
G01I07D
G01I08
G01I09
G01U09
G01I10
G01I11
G01I12
G01U12
G01I13
G01I14
G01I15
G01U15
G01I16
G01I17
G01I18
G01U18
G01I19
G01I20
G01I21
G01U21
G01I22
G01I23
G01I24
G01U24
G01I25
G01I26
G01I27
G01I27D
G01U27
G01I28
G01U28
G01I29
G01U29
G01I30
G01U30
G01I31
SAMPLE I.D.

Figure D.2.5-2

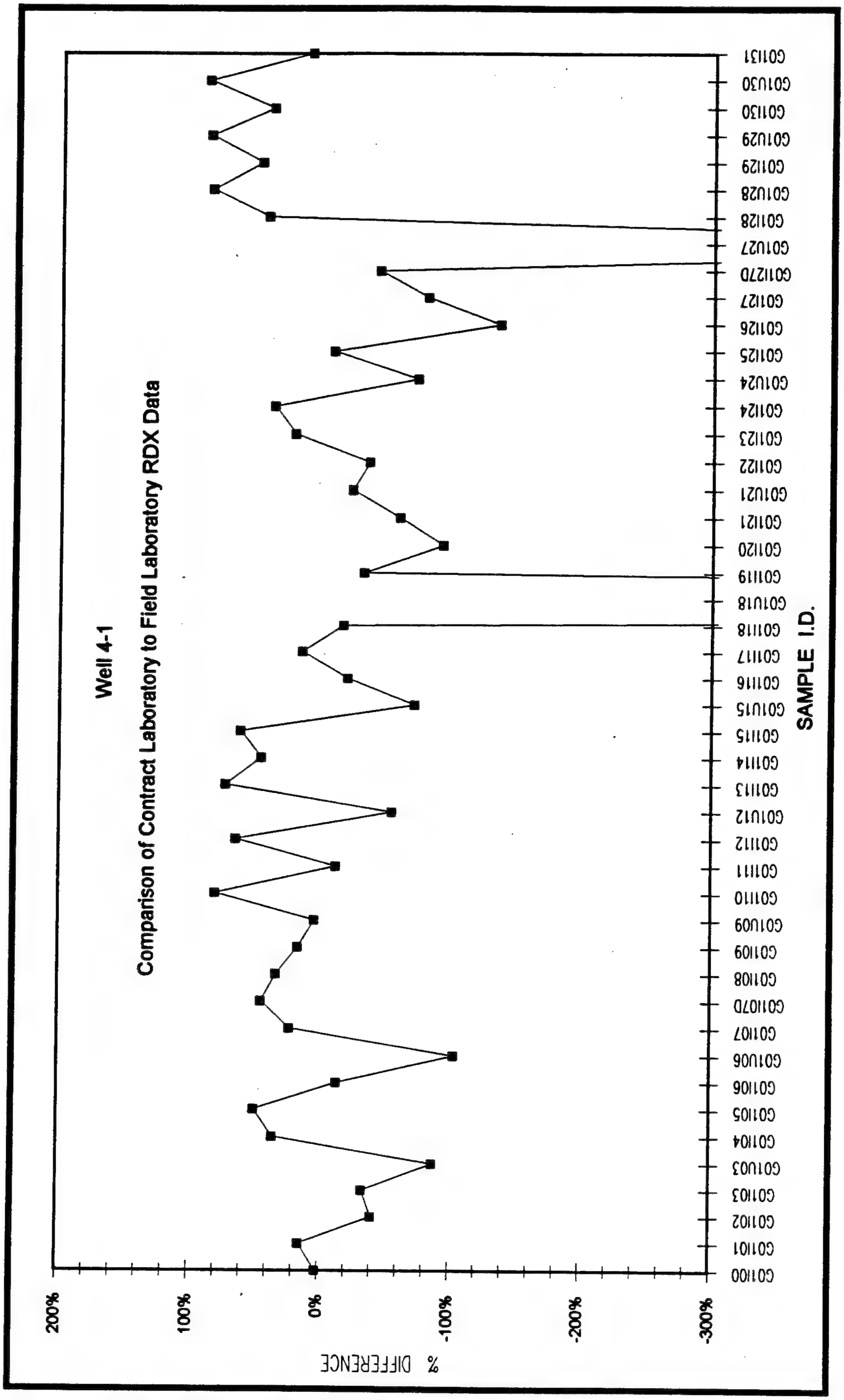
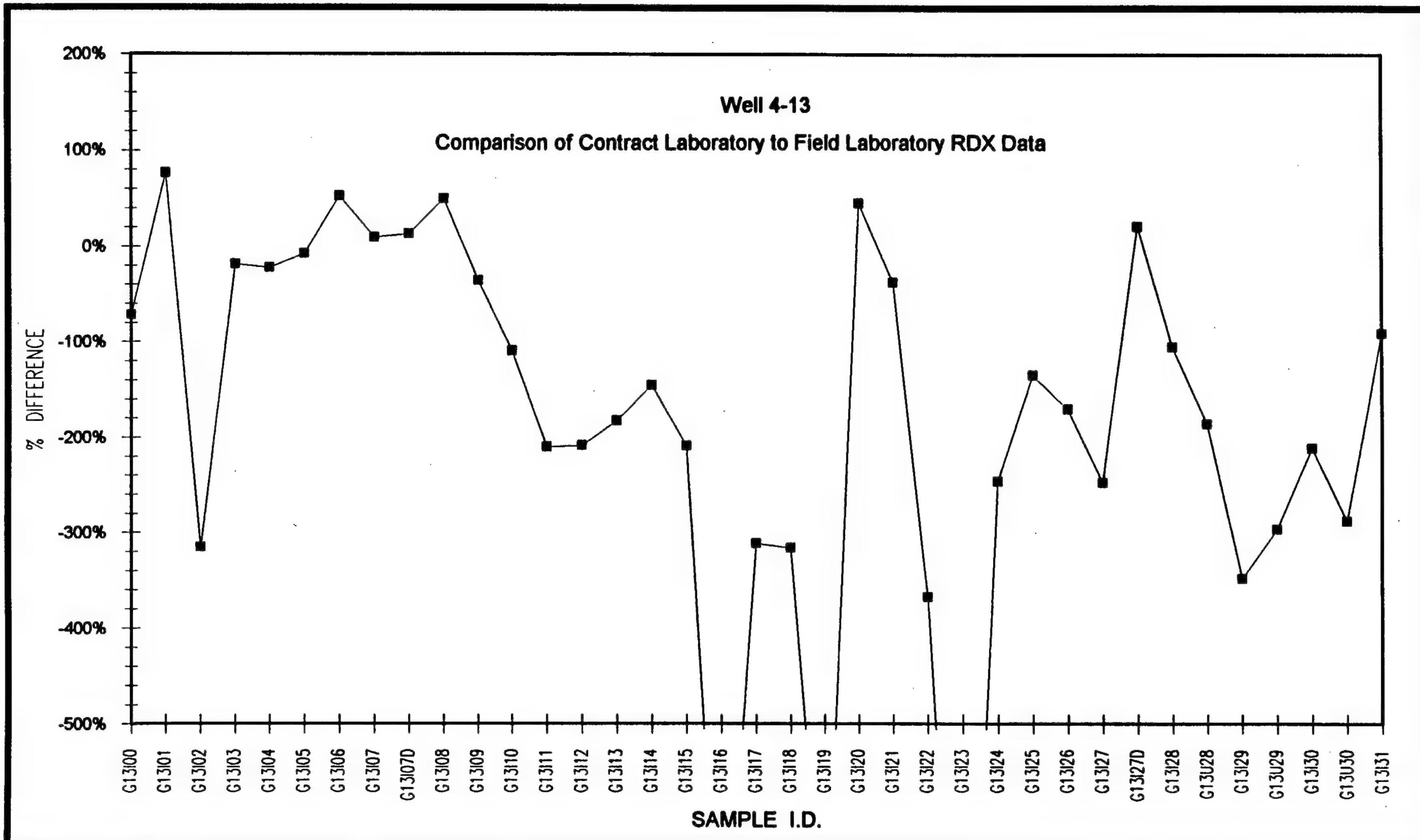

Well 4-1
Comparison of Contract Laboratory to Field Laboratory RDX Data
% DIFFERENCE
200%
100%
0%
-100%
-200%
-300%
SAMPLE I.D.
G01100
G01101
G01102
G01103
G01U03
G01104
G01105
G01106
G01U06
G01107
G01107D
G01108
G01109
G01U09
G01110
G01111
G01112
G01U12
G01113
G01114
G01115
G01U15
G01116
G01117
G01118
G01U18
G01119
G01120
G01121
G01U21
G01122
G01123
G01124
G01U24
G01125
G01126
G01127
G01127D
G01U27
G01128
G01U28
G01129
G01U29
G01130
G01U30
G01131

Figure D.2.5-3



Well 4-13
Comparison of Contract Laboratory to Field Laboratory RDX Data
200%
100%
0%
-100%
-200%
-300%
-400%
-500%
% DIFFERENCE
G13100
G13101
G13102
G13103
G13104
G13105
G13106
G13107
G13107D
G13108
G13109
G13110
G13111
G13112
G13113
G13114
G13115
G13116
G13117
G13118
G13119
G13120
G13121
G13122
G13123
G13124
G13125
G13126
G13127
G13127D
G13128
G13U28
G13129
G13U29
G13130
G13U30
G13131
SAMPLE I.D.

This comparison also suggests that the field method may perform better with samples collected from well 4-1 as compared to well 4-13. This may indicate that matrix interference is more prevalent in groundwater samples collected from well 4-13.

D.2.5 OBSERVED DEFICIENCIES WITH FIELD METHOD

Several deficiencies were observed during implementation of the field method. These deficiencies included color development, extraction efficiency and cost and availability of the SPE cartridges. These deficiencies should be considered empirical and are based on daily observations by the field chemists as well as a review of the QC results. In summary, method performance for RDX is considered to have been poor to moderate and for TNT is considered to have been moderate to good. This assessment is based on the utilization of the method as a field tool for approximate analyte concentrations on a relatively fast turnaround.

D.2.5.1 RDX Color Development

The color development for RDX appeared to be inadequate and inconsistent in both the samples and the standards. The RDX color development of field samples was inconsistent from analysis to analysis as quantitatively evident from the QA/QC sample duplicate results. The RPD between the sample result and the sample duplicate result ranged from 14 (November 3, 1993) to 799 (October 31, 1993). A comparison of the field method data and the contract laboratory data showed large differences between the reported results. In general, RDX results of field-analyzed samples were higher than those for the contract laboratory split samples.

Color development for the RDX initial calibration standards was inconsistent throughout the entire field screening project. This is evident from high percent relative standard deviations for the two initial calibration curves generated during the analyses of samples. The percent relative standard deviation for the October 13 initial calibration was 31 and the percent relative standard deviation for the October 27 initial calibration was 33. The %Ds of the average response factors for the continuing

calibrations varied greatly throughout the course of the field project. The %D averaged at 37 for 29 continuing calibration standards and ranged from 2 to 89.

Although a specific reason for the apparent problems with the RDX method cannot be cited with certainty, two possible reasons are likely. These include matrix interferences and the reduction step in the color development reaction. Matrix interferences could result in low and/or high percent recoveries for the matrix spike samples and in poor RPDs for sample duplicates as well as between field-analyzed samples and contract laboratory-analyzed samples. Inadequate reduction during color development may have resulted from matrix interferences but may also have resulted from storage or use of zinc dust as the reductive agent.

It was determined during the course of the field project that the zinc dust became ineffective over time. Since the field laboratory was not equipped with a desiccator, the zinc dust was stored in a sealed container under ambient conditions. Upon realizing that the stock supply of zinc dust may have degraded, a fresh container of zinc dust was used in the color development process. The %D for RDX went from 89 on October 15 (using old zinc dust) to 12 on October 16 (using fresh zinc dust). The %D remained less than 25 for the next three extraction sets over two days while using the new zinc dust.

There was also concern regarding the time the zinc dust was in contact with the extract. Fifteen seconds was the method-recommended time that the zinc dust was to be in contact with the extract. It was not clear if incubation time was sufficient to allow the zinc to reduce the analytes in solution for proper color development to occur. Furthermore, it is possible that zinc dust is not a strong enough reductant for the intended application. During telephone conversations between the field chemists and the technical support division of the Hach Company, it was suggested that cadmium may be a more effect reductant.

D.2.5.2 TNT and RDX Extraction Efficiencies

The SPE vacuum manifold system used in the extraction of the groundwatersamples for the analysis of TNT and RDX method did not allow for accurate flow rate calibration. Furthermore, it was difficult to maintain a consistent flow rate throughout sample extraction. Up to eight sample extractions were performed simultaneously using the vacuum manifold. The flow rate was kept to a dropwise extraction and was approximately 5 to 10 milliliters per minute (ml/min). Generally, each one liter sample was extracted within two hours from the beginning of sample extraction. In summary, a non-optimum extraction flow rate and the variations in extraction flow rate through the SPE cartridges may have affected the extraction efficiencies for TNT and RDX.

D.2.5.3 Cost and Availability of the SPE Cartridges

The Heyesep R™ SPE cartridges were purchased from Supelco, Inc., as a special order item. These cartridges required approximately two to three weeks for the manufacturer to produce and ship. The cost of these cartridges was several times higher than a standard product.

D.2.6 RECOMMENDATIONS FOR FURTHER METHOD DEVELOPMENT

Based on the performance of the field program, additional experimentation could be conducted which could allow the field method to be developed further. Several modifications could be evaluated which may alleviate or reduce many of the observed deficiencies presented in the preceding section. These include the following:

- Equipping the field laboratory with a desiccator for storing the reductant.
- Replacing the zinc powder with a more powerful reductant, such as cadmium.
- Replacing the Hach NitriVer 3™ reagent with the Greiss reagent.
- Replacing the colorimetric method with a field lab based on a more proven method such as SW-846 Method 8330, which utilizes a high pressure liquid

chromatograph (HPLC). As another option, the applicability of the relatively new immunoassay methods could be evaluated.

D.3 REVISED FINAL FIELD METHOD SOP FOR THE DETERMINATION OF TNT AND RDX IN GROUNDWATER (U.S. ARMY ENVIRONMENTAL CENTER, JUNE 1995)

I. Summary

A. Analytes: This method is suitable for determining the concentration of TNT and RDX in the field using AC or DC powered equipment.

B. Matrix: This method is suitable for the determination of TNT and RDX in water.

C. General Method: Nitroaromatics are extracted from water samples with a Porapak™ R solid phase extraction cartridge and are eluted with acetone. Color is developed in aliquots of the acetone extract with potassium hydroxide and sodium sulfate, in the case of TNT, and acetic acid, zinc dust, and Hach NitriVer 3 powder, in the case of RDX. The colored solutions are read on a Hach DR 2000 DC powered, single beam spectrophotometer or a Hitachi U2000 AC powered, dual beam spectrophotometer at 540 nm and 507 nm, respectively, and the absorbance compared to a standard curve to establish concentration.

II. Application

A. Calibration Range: The method was developed to address concentrations ranging from 5 to 5000 μg/L. Sample concentrations beyond the upper calibration limit will be diluted and reanalyzed.

B. Tested Concentration Range: This method was tested over the range of 5 to 5000 μg/L.

C. Sensitivity: The sensitivity at the method detection limit is dependent on the level of concentration employed in the extraction, which is, in turn, dependent upon the concentration expected or encountered in the sample. Within the typical working range

of the spectrophotometer (i.e., Hach DR-2000) and in unconcentrated samples, the average absorbance per μg/L was found to be 0.00027 for TNT and 0.00009 for RDX.

D. Interferences: No interference was noted between TNT and RDX in solution. Potential interferences in the field are expected to be the same as those given in the related methods presented in Appendices A, B, and C.

E. Safety Information: See Appendix D.

III. Apparatus and Chemicals

A. Instrumentation

1. Field portable, DC powered, single beam spectrophotometer (Hach DR-2000 spectrophotometer or equivalent, bandpass 20 nm). Alternatively, fixed base, AC powered, dual beam spectrophotometer (Hitachi U-2000 spectrometer or equivalent, bandpass 2 nm).

B. Analytes:

TNT (2,4,6-trinitrotoluene)
BP: 280° C (explodes)
MP: 80.1° C
Solubility in water: 130 mg/L
Octanol/water partition coefficient: 68
CAS # 118-96-7
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)
MP: 204° C
Solubility in water: 60 mg/L
Octanol/water partition coefficient: 7.5
CAS # 121-82-4

C. Reagents and SARMs:

1. TNT (standard)
2. RDX (standard)
3. Acetone
4. Potassium hydroxide (KOH, reagent grade pellets)
5. Sodium sulfite (reagent grade)
6. Glacial acetic acid (reagent grade)
7. Hach NitriVer 3 powder pillows

8. Zinc dust (325 mesh)
9. Type II water

D. Equipment:

1. Heyesep R™ R solid phase extraction cartridge, 1 g in 3 ml tube
2. One-hole stoppers
3. Vacuum flasks (1 and 4L)
4. Vacuum tubing
5. 30 mL disposable amber screw cap vials
6. Graduated cylinders
   500 ml
   100 ml
   50 ml
   10 ml
7. Disposable syringes
   10 ml
   30 ml
   60 ml
8. Volumetric flasks
   10 ml
   25 ml
   50 ml
   100 ml
   250 ml
9. Glass cuvette, 1 cm pathlength
10. Vacuum pump
11. Stopwatch
12. Cold storage
13. Glass tubing
14. Vial rack
15. Glassware cleaning supplies
16. Nail clipper
17. Spatula
18. Squirt bottles
19. Adaptors for sample reservoir
20. Sample reservoirs (60 ml)
21. Flask holder
22. Syringe filters (0.45 micron)
23. Supelco Visiprep DL Vacuum Manifold
24. Disposable liners

IV. Calibration

A. Preparation of Standards: Initial stock standard solutions should be obtained at concentrations of 1000 mg/L for TNT and RDX. A working stock standard is prepared at 20 mg/L for TNT and RDX. Calibration solutions are prepared in acetone at concentrations of 100, 250, 500, 1000 and 5000 μg/L for TNT. Calibration solutions are prepared at 100, 250, 500, 1000, and 5000 μg/L for RDX. (Note that during method validation, it was not possible to distinguish between blank, 5, and 10 μg/L standards for RDX. Thus, sample concentration was used for analysis.) Approximately 3 ml of water are added to the calibration standards for each 100 ml of acetone employed to ensure adequate color development. Glass volumetric flasks and syringes are used for this purpose. Standards should be stored in amber bottles and stored in the dark at 4° C.

B. Initial Calibration: A 25 ml aliquot of each standard for TNT and a 5 ml aliquot of each standard for RDX is used and processed, as discussed in Sections VIIB and VIIC, respectively.

The zero absorbance setting is established by preparing TNT and RDX reagent blanks. The TNT reagent blank is 24 ml of acetone and 1 ml of water and the RDX reagent blank is 5 ml of acetone. Both reagent blanks are processed through the color development procedure as described in Section VIIIB for TNT and Section VIIC for RDX. Zero the instrument according to manufacturer's instructions. Measure and record the absorbance for each TNT and RDX calibrations standard separately at 540 and 507 nm, respectively. Calculate a correlation coefficient and an average response factor for each data set. If the correlation coefficient is > 0.995, linearity can be assumed. If not, prepare a calibration curve for future use.

C. Continuing Calibration: Continuing calibration is performed using a mid-range standard at a frequency of one per extraction batch (500 μg/L for TNT and RDX). The continuing calibration standard result should be within 80 to 120 percent of the true value. If the daily calibration check fails to meet this criterion, re-run the

calibration check. If the second calibration check also fails, a new initial calibration is required.

D. Calculations

The correlation coefficient is calculated as follows:

$$r = \frac{\sum M_1 M_2}{\sqrt{((\sum M^2_1)(\sum M_2^2))}}$$

where: r = correlation coefficient

M_1 = known concentration of a standard

M_2 = instrument response for that standard.

The response factor for each standard is calculated as follows:

$$RF = \frac{A_s}{C_s}$$

where: RF = response factor

A_s = absorbance of the standard

C_s = known concentration of the standard.

The average response factor is calculated as follows:

$$R_a = \frac{(R_1 + R_2 + \ldots R_n)}{n}$$

where: R_a = average response factor

R_n = response factor for a given standard

n = number of standards in the curve.

The recovery of the daily calibration check is calculated as follows:

$$R_d = \frac{C_d}{C_s}$$

where: R_d = recovery of the daily calibration check
C_d = concentration of the daily calibration check
C_s = known concentration of the standard.

V. Certification Testing

The ability of the analyst to perform the method with acceptable precision and accuracy must be demonstrated prior to its use in the field.

Two sets of spiked sample solutions are prepared at the same concentrations as the calibration standards. The samples are analyzed and the results are recorded in µg/L. A percent recovery is calculated using the following formula:

$$\%R = \frac{\text{Concentration Measured}}{\text{Known Concentration}}$$

% R should fall within the range of 75 - 125 for each analyte at each concentration.

A Relative Percent Difference (RPD) should be calculated for each concentration pair as follows:

$$RPD = \frac{|(R_1 - R_2)|}{(R_1 + R_2)/2} \times 100$$

where: RPD = relative percent difference
R_1 = result of the first analysis
R_2 = result of the second analysis.

The RPD should be less than 25% for each analyte at each concentration.

VI. Sample Handling

Samples should be stored at 4° C in amber glass bottles, in the dark, prior to analysis. Samples should be analyzed within 24 hours of collection. Samples with concentrations less than 1000 $\mu g/L$ will require pre-concentration prior to analysis. The analyst will be required to adjust instrument reported concentrations by the appropriate concentration factor to arrive at a final sample concentration.

VII. Procedure

A. Pre-Concentration of Water Sample: A 500-ml graduated cylinder is used to measure out a 1000-ml aliquot of sample. Connect the vacuum pump to a 1 L vacuum flask. Connect the Heyesep R™ solid phase extraction (SPE) cartridge to the SPE vacuum manifold system. Fit the barrel of a 60 ml disposable syringe into the top of an extraction cartridge. Rinse the extraction cartridge and 60 ml reservoir (i.e., disposable syringe) with approximately 10 ml of acetone from a squirt bottle. Apply a slight vacuum to draw the acetone through the extraction cartridge. Rinse the extraction cartridge and reservoir with approximately 25 ml of deionized water to remove acetone using a slight vacuum. Repeat the deionized water rinse.

Filter the sample through the extraction cartridge at approximately 5 to 10 mL/minute (1 liter of sample should be filtered in 2 hours). Rinse the extraction cartridge with approximately 25 ml of deionized water to remove interfering ions.

Release vacuum. Properly dispose of filtrate. Add 10 ml of acetone to the extraction cartridge and let stand for 8 minutes. After 8 minutes elute the sample with just enough vacuum to pull the acetone through the extraction cartridge into 30 ml amber vial.

Immediately upon cessation of elution, release vacuum, bring the extract to 10 ml with acetone, and separate the eluant into two 5 ml aliquots. One 5 ml aliquot is used for RDX determination. The second is diluted to 25 ml with acetone and 1 ml of water for TNT determination.

Sample concentrations beyond the upper calibration limit will be diluted and reanalyzed.

B. TNT Test: A 25 ml aliquot of extract is poured into the barrel of a 30 ml disposable syringe and syringe-filtered into a clean sample vial with 1 pellet of KOH and about 1 g of Na_2SO_3. The vial is shaken for 3 minutes and is then allowed to stand for an additional 18 minutes. (A total of 20 minutes is needed for adequate color development.) The extract is then syringe-filtered into a clean 30 ml amber vial. Color development is complete at the end of the filtration. The solution is read on the spectrophotometer at 540 nm. The final concentration factor is 20X.

C. RDX Test: A 5 ml aliquot of extract is acidified by adding 500 μl of glacial acetic acid. The acidified extract is poured into the barrel of a 10 ml disposable syringe which contains approximately 0.3 g of zinc dust. After 15 seconds, the solution is syringe-filtered into a 30 ml amber vial containing 20 ml of deionized water and the content of 1 NitriVer 3 powder pillow. The vial is shaken to mix the reagents and allowed to stand for 25 minutes. The mixture is then syringe-filtered into a clean 30 ml amber vial and read on the spectrophotometer at 507 nm. The final concentration factor is 20X.

VIII. Calculations

The sample concentration is arrived at using the following formula:

$$C_s\ \mu g/L = \frac{(A_s/RF)}{CF}$$

where: C_s = concentration in the sample

A_s = absorbance of the sample

RF = response factor taken from the daily calibration

CF = concentration factor.

IX. Daily Quality Control

Daily quality control consists of the following checks:

1. Blank - A method blank will be processed daily. Results of the blank analysis should be < the detection limit. An acceptable blank must be analyzed prior to analysis of field samples.

2. Blank spike - A method blank, spiked at 500 $\mu g/L$ (in final extract/25 $\mu g/L$ in sample), should be processed daily.

3. Matrix spike - A field sample, spiked at 500 $\mu g/L$ (in final extract/25 $\mu g/L$ in sample), should be analyzed daily. The sample chosen for the matrix spike should have a concentration < 1000 $\mu g/L$ but should not be a blank. Calculate a percent recovery as follows:

$$\%R = \frac{C_{ms} - C_s}{C_k}$$

where: $\%R$ = percent recovery

C_{ms} = concentration of the matrix spike

C_s = concentration of the unspiked sample

C_k = known concentration of the spike.

%R for matrix spikes should initially fall within the range of 75 -125. Control charts should be established based on daily matrix spike results and used according to the USAEC QA guidance documents (USATHAMA, 1987, 1990, 1993).

4. Duplicate - a sample duplicate should be performed daily. Calculate a relative percent difference using the formula given in Section V.

The RPD should initially be < 25%. Control charts should be established based on daily duplicate results and used according to USAEC QA guidance documents (USATHAMA, 1987, 1990, 1993).

Note: This Revised Final SOP appears in the following report:

Dames & Moore, 1995. Report on Treatability Test of Groundwater by Ultraviolet (UV)/Oxidation, Umatilla Depot Activity, Hermiston, Oregon, U.S. Army Environmental Center, Aberdeen Proving Ground, June 1995.

Copies of this report or further information in the SOP may be obtained from:

Dr. Charles Lechner/SFIM-AEC-BCA
U.S. Army Environmental Center
Building 4480
Aberdeen Proving Ground, MD 21010
Phone: (410) 671-1605

-or-

Dr. Stephen Lemont
Dames & Moore
849 International Drive, Suite 320
Linthicum, MD 21090
Phone: (410) 859-5040

D.4 REFERENCES

Dames & Moore, 1993. Final Method Validation Report, Field Method for the Determination of TNT and RDX in Groundwater, Report No. ENAEC-BC-CR-93106, prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, September 1993.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1990. Quality Assurance Program, Aberdeen Proving Ground, Maryland, January 1990.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1987. Quality Assurance Program, Aberdeen Proving Ground, Maryland.

U.S. Army Environmental Center (USAEC), 1993. Guidelines for Implementation of ER 1110-1-263 for USAEC Projects, Aberdeen Proving Ground, Maryland, May 1993.

D.5 INITIAL AND DAILY CALIBRATION WORKSHEETS

DAMES & MOORE

TNT Field Screening Analysis

Initial Calibration Worksheet

UMDA

Date: Oct. 11, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	2	98.8	0.005	5.06E-05				
250 ppb	3	247	0.012	4.86E-05				
500 ppb	4	494	0.022	4.45E-05				
1000 ppb	5	988	0.047	4.76E-05				
5000 ppb	6	4940	0.229	4.64E-05	4.75E-05	4.81	0.9999	

UV D-39

RF = As/Cs RSD = (standard deviation n-1/average RF) x 100

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	15	10/12/93	494	0.02	4.05E-05	4.75E-05	-14.8	
500 ppb	19	10/13/93	494	0.019	3.85E-05	4.75E-05	-19.1	
500 ppb	2	10/14/93	494	0.021	4.25E-05	4.75E-05	-10.6	
500 ppb	18	10/14/93	494	0.017	3.44E-05	4.75E-05	-27.6	
500 ppb	42	10/14/93	494	0.019	3.85E-05	4.75E-05	-19.1	
500 ppb	28	10/15/93	494	0.014	2.83E-05	4.75E-05	-40.4	low recovery - use for calc
500 ppb	37	10/15/93	494	0.021	4.25E-05	4.75E-05	-10.6	
500 ppb	17	10/16/93	494	0.021	4.25E-05	4.75E-05	-10.6	
500 ppb	44	10/16/93	494	0.015	3.04E-05	4.75E-05	-36.1	low recovery
500 ppb	15	10/17/93	494	0.017	3.44E-05	4.75E-05	-27.6	
500 ppb	38	10/17/93	494	0.02	4.05E-05	4.75E-05	-14.8	
500 ppb	48	10/17/93	494	0.026	5.26E-05	4.75E-05	10.7	

RF = As/Cs RSD = (standard deviation n-1/average RF) x 100 * - Ra taken from initial calibration

%D = ((RF - Ra)/Ra) x 100

DAMES & MOORE

TNT Field Screening Analysis
Initial Calibration Worksheet
UMDA
Date: Oct. 11, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	2	98.8	0.005	5.06E-05				
250 ppb	3	247	0.012	4.86E-05				
500 ppb	4	494	0.022	4.45E-05				
1000 ppb	5	988	0.047	4.76E-05				
5000 ppb	6	4940	0.229	4.64E-05	4.75E-05	4.81	0.9999	

UV
D-40

RF = As/Cs RSD = (standard deviation n-1/average RF) x 100

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	9	10/18/93	494	0.02	4.05E-05	4.75E-05	-14.8	
500 ppb	13	10/19/93	494	0.016	3.24E-05	4.75E-05	-31.9	

RF = As/Cs RSD = (standard deviation n-1/average RF) x 100 * - Ra taken from initial calibration

%D = ((RF - Ra)/Ra) x 100

DAMES & MOORE

TNT Field Screening Analysis

Initial Calibration Worksheet

UMDA

Date: Oct. 27, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	8	100.4	0.004	3.98E-05				
250 ppb	9	251	0.012	4.78E-05				
500 ppb	10	502	0.022	4.38E-05				
1000 ppb	11	1004	0.038	3.78E-05				
5000 ppb	12	5020	0.225	4.48E-05	4.28E-05	9.30	0.9995	

RF = As/Cs

RSD = (standard deviation n-1/average RF) x 100

UV
D-41

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	4	10/28/93	502	0.023	4.58E-05	4.28E-05	7.0	
500 ppb	57	10/28/93	502	0.022	4.38E-05	4.28E-05	2.3	
500 ppb	3	10/29/93	502	0.021	4.18E-05	4.28E-05	-2.3	
500 ppb	35	10/29/93	502	0.019	3.78E-05	4.28E-05	-11.6	
500 ppb	45	10/29/93	502	0.025	4.98E-05	4.28E-05	16.3	
500 ppb	2	10/30/93	502	0.022	4.38E-05	4.28E-05	2.3	
500 ppb	32	10/30/93	502	0.025	4.98E-05	4.28E-05	16.3	
500 ppb	2	10/31/93	502	0.022	4.38E-05	4.28E-05	2.3	
500 ppb	32	10/31/93	502	0.021	4.18E-05	4.28E-05	-2.3	
500 ppb	42	10/31/93	502	0.028	5.58E-05	4.28E-05	30.2	Do not use for calculation
500 ppb	2	11/1/93	502	0.023	4.58E-05	4.28E-05	7.0	
500 ppb	36	11/1/93	502	0.025	4.98E-05	4.28E-05	16.3	

RF = As/Cs

RSD = (standard deviation n-1/average RF) x 100

* - Ra taken from initial calibration

%D = ((RF - Ra)/Ra) x 100

DAMES & MOORE

TNT Field Screening Analysis

Initial Calibration Worksheet

UMDA

Date: Oct. 27, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	8	100.4	0.004	3.98E-05				
250 ppb	9	251	0.012	4.78E-05				
500 ppb	10	502	0.022	4.38E-05				
1000 ppb	11	1004	0.038	3.78E-05				
5000 ppb	12	5020	0.225	4.48E-05	4.28E-05	9.30	0.9995	

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RF = As/Cs RSD = (standard deviation n-1/average RF) x 100

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	2	11/2/93	502	0.021	4.18E-05	4.28E-05	-2.3	
500 ppb	32	11/2/93	502	0.018	3.59E-05	4.28E-05	-16.3	
500 ppb	12	11/3/93	502	0.022	4.38E-05	4.28E-05	2.3	
500 ppb	34	11/3/93	502	0.021	4.18E-05	4.28E-05	-2.3	

RF = As/Cs RSD = (standard deviation n-1/average RF) x 100 * - Ra taken from initial calibration

%D = ((RF - Ra)/Ra) x 100

DAMES & MOORE

RDX Field Screening Analysis
Initial Calibration Worksheet
UMDA

Date: Oct. 13, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	4	99.2	0.005	5.04E-05				
250 ppb	5	248	0.011	4.44E-05				
500 ppb	6	496	0.013	2.62E-05				
1000 ppb	7	992	0.032	3.23E-05				
5000 ppb	8	4960	0.13	2.62E-05	3.59E-05	30.6	0.999	

UV
D-43

RF = As/Cs

RSD = (standard deviation n-1/average RF) x 100

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	9	10/13/93	496	0.012	2.42E-05	3.59E-05	-32.6	
500 ppb	10	10/14/93	496	0.012	2.42E-05	3.59E-05	-32.6	
500 ppb	32	10/14/93	496	0.015	3.02E-05	3.59E-05	-15.7	
500 ppb	56	10/14/93	496	0.01	2.02E-05	3.59E-05	-43.8	
500 ppb	17	10/15/93	496	0.014	2.82E-05	3.59E-05	-21.3	use for all data calc on 10/15
500 ppb	44	10/15/93	496	0.002	4.03E-06	3.59E-05	-88.8	obvious color development@
1000 ppb	15	10/16/93	992	0.035	3.53E-05	3.59E-05	-1.7	
500 ppb	31	10/16/93	496	0.016	3.23E-05	3.59E-05	-10.1	
500 ppb	2	10/17/93	496	0.014	2.82E-05	3.59E-05	-21.3	
500 ppb	28	10/17/93	496	0.017	3.43E-05	3.59E-05	-4.5	
500 ppb	59	10/17/93	496	0.007	1.41E-05	3.59E-05	-60.7	poor color development**

RF = As/Cs

%D = ((RF - Ra)/Ra) x 100

RSD = (standard deviation n-1/average RF) x 100

* - Ra taken from initial calibration

DAMES & MOORE

RDX Field Screening Analysis
Initial Calibration Worksheet
UMDA
Date: Oct. 13, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	4	99.2	0.005	5.04E-05				
250 ppb	5	248	0.011	4.44E-05				
500 ppb	6	496	0.013	2.62E-05				
1000 ppb	7	992	0.032	3.23E-05				
5000 ppb	8	4960	0.13	2.62E-05	3.59E-05	30.6	0.999	

UV
D-44

RF = As/Cs

RSD = (standard deviation n-1/average RF) x 100

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	26	10/18/93	496	0.007	1.41E-05	3.59E-05	-60.7	Poor Color Development
500 ppb	4	10/19/93	496	0.007	1.41E-05	3.59E-05	-60.7	Poor Color Development

RF = As/Cs

%D = ((RF - Ra)/Ra) x 100

RSD = (standard deviation n-1/average RF) x 100

* - Ra taken from initial calibration

DAMES & MOORE

RDX Field Screening Analysis
Initial Calibration Worksheet
UMDA

Date: Oct. 27, 1993

Standard	Anal. No.	Standard Conc. (ug/L) (Cs)	Standard Abs. (As)	Response Factor (RF)	Ave RF (Ra)	Relative Standard Deviation (RSD)	Corr Coef (r)	Comments
100 ppb	2	107.4	0.005	4.66E-05				
250 ppb	15	268.5	0.006	2.23E-05				
500 ppb	4	537	0.016	2.98E-05				
1000 ppb	16	1262	0.027	2.14E-05				
5000 ppb	6	5370	0.171	3.18E-05	3.04E-05	33.3	0.9967	

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RF = As/Cs

RSD = (standard deviation n-1/average RF) x 100

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	33	10/28/93	537	0.019	3.54E-05	3.04E-05	16.4	
500 ppb	47	10/28/93	537	0.022	4.10E-05	3.04E-05	34.8	
500 ppb	13	10/29/93	537	0.01	1.86E-05	3.04E-05	-38.7	
500 ppb	24	10/29/93	537	0.02	3.72E-05	3.04E-05	22.6	
500 ppb	56	10/29/93	496	0.014	2.82E-05	3.04E-05	-7.1	
500 ppb	13	10/30/93	537	0.005	9.31E-06	3.04E-05	-69.4	do not use for quantitation
500 ppb	23	10/30/93	537	0.017	3.17E-05	3.04E-05	4.2	use for all daily quantitation
500 ppb	12	10/31/93	537	0.016	2.98E-05	3.04E-05	-1.9	
500 ppb	22	10/31/93	537	0.01	1.86E-05	3.04E-05	-38.7	
500 ppb	52	10/31/93	537	0.03	5.59E-05	3.04E-05	83.8	Re-extracted on 11/1/93
500 ppb	13	11/1/93	537	0.009	1.68E-05	3.04E-05	-44.8	
500 ppb	23	11/1/93	537	0.008	1.49E-05	3.04E-05	-51.0	

RF = As/Cs

%D = ((RF - Ra)/Ra) x 100

RSD = (standard deviation n-1/average RF) x 100

* - Ra taken from initial calibration

DAMES & MOORE

Daily Continuing Calibration Worksheet

Standard	Anal. No.	Analysis Date	STD Conc. (ug/L) (Cs)	Standard Abs.	Response Factor (RF)	Average RF (Ra)*	Percent Difference (%D)	Comments
500 ppb	12	11/2/93	537	0.005	9.31E-06	3.04E-05	-69.4	do not use
500 ppb	22	11/2/93	537	0.003	5.59E-06	3.04E-05	-81.6	do not use
500 ppb	14	11/3/93	537	0.016	2.98E-05	3.04E-05	-1.9	
500 ppb	25	11/3/93	537	0.009	1.68E-05	3.04E-05	-44.8	do not use

RF = As/Cs

RSD = (standard deviation n-1/average RF) x 100

* - Ra taken from initial calibration

%D = ((RF - Ra)/Ra) x 100

UV
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D.6 DAILY ANALYSIS LOGS

TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 10/4/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK TNT	1	08:49	540 nm WAVELENGTH
TNT 500 PPB STD	2		
REAGENT BLANK RDX	3	10:01	507 nm WAVELENGTH
500 PPB STD.	4	10:48	
1000 PPB STD	5	10:51	1000ppb standard
1000 ppb STD	6	11:25	read at 88% after 15 min
1000 ppb STD	7	11:30	92% after 20 min.
MB - RDX	8		
MBS - RDX 500ppb	9	14:12	
~~MB - TNT~~ Reagent blank	10		
MB - TNT	11		
MBS - TNT	12	~~14:13~~	
500 PPB TNT	10		
500 PPB TNT	11		
METHOD BLANK TNT	12	14:32	Blank
METHOD BLANK SPIKE TNT	13	14:36	100%R
REAGENT BLANK RDX	14		
RDX BLANK SPIKE	15		
TNT 500 PPB	16	15:28	
TNT 500 PPB	17	15:31	
TNT 500 PPB	18	15:37	

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DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 10/6/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1		
100 PPB RDX	2		
250 PPB RDX	3		
500 PPB RDX	4		
1000 PPB RDX	5		
5000 PPB RDX	6		
5000 PPB RDX	~~6~~ 7		
1000 PPB RDX	8		
500 PPB RDX	9		AUTOZERO AFTER ANALYSIS
~~500 PPB RDX~~ 250 PPB RDX	~~10~~ 11		
100 PPB RDX	12		
MB 10/5/93	~~2~~ 13		
BS #1 10/5	~~3~~ 14		
BS #2 10/5	~~4~~ 15		
BS #3 10/5	~~5~~ 16		
BS #4 10/5	~~16~~ 17		
BS #5 10/5	~~17~~ 18		
BS #6 10/5	~~18~~ 19		
500 PPB RDX	20		
500 PPB RDX	21		~~85%~~ 15% D RUN ANALYSES
METHOD BLANK RDX 10/6	22		
BS #1 RDX 10/6	23		308.1
BS #2 RDX 10/6	24		1614
BS #3 RDX 10/6	25		1210
BS #4 RDX 10/6	26		947.4
BS #5 RDX 10/6	27		1184
~~50~~ 500 PPB TNT	28	17:55	AUTOZEROED w/ TNT RB. -> STD LOW
MB 10/6 TNT	29	17:57	ABS
BS #1 10/6 TNT	30	17:59	478.5 ABS
BS #2 10/6 TNT	31	18:01	456.6
BS #3 10/6 TNT	32	18:03	
BS #4 10/6 TNT	33	18:05	
BS #5 10/6 TNT	34	18:07	

TNT and RDX Field Screening Analysis — **DAMES & MOORE**

Daily Analysis Log

UMDA

Date : 10/11

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK TNT	1	15:32	540 nm WL
100 PPB TNT	2	15:33	
250 PPB TNT	3	15:36	
500 PPB TNT	4	15:39	
1000 PPB TNT	5	15:41	
5000 PPB TNT	6	15:44	r = 0.9999
Water Blank	7	16:38	
Water ~~Blank~~ Spike 1	8	16:42	
Water Spike 2	9	16:46	
Sample 1 ~~Spike~~	10	16:49	
Sample 2 Spike	11	16:55	
Sample 3 Spike	12	16:58	
500 PPB TNT	13	17:09	
50 PPB TNT	14	17:40	
10,000 PPB TNT	15	17:43	

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/12

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
Reagent Blank	1	15:21	RDX ANALYSIS 507 nm WAVELENGTH
100 ppb RDX	2	15:27	
250 ppb RDX	3	15:30	
500 ppb RDX	4	15:33	
1000 ppb RDX	5	15:37	
5000 ppb RDX	6	15:40	
Method Blank ~~TNT~~ RDX	7	15:55	
Blank Spike RDX	8	15:59	
4-1 Dup RDX	9	16:02	
4-1 RDX	10	16:05	
4-1 MS RDX	11	16:07	
4-1 MSD RDX	12	—	
REAGENT BLANK	13	16:42	TNT ANALYSIS 540 nm WAVELENGTH
REAGENT BLANK	14	16:42	AUTOZEROED
500 PPB TNT	15	16:45	
METHOD BLANK TNT 10/12	16	16:50	
BLANK SPIKE TNT 10/12	17	16:52	AUTOZEROED BEFORE ANALYSIS
4-1	18	16:56	AUTOZEROED BEFORE ANALYSIS
4-1 DUP	19	16:58	AUTOZEROED BEFORE ANALYSIS
4-1 MS	20	17:00	AUTOZEROED BEFORE ANALYSIS
4-1 MSD	21	17:03	

UV

TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 10/13/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	11:12	RDX ANALYSIS - 507 nm - AUTOZEROED
100 PPB STD RDX	2	12:08	REPREP STANDARDS
REAGENT BLANK	3	17:01	
100 PPB RDX	4	17:02	
250 PPB RDX	5	17:03	
500 PPB RDX	6	17:05	
1000 PPB RDX	7	17:06	
5000 PPB RDX	8	17:08	r = 0.9987 w/RB r=0.9990 w/out RB
500 PPB RDX	9	19:20	AUTOZEROED W/NEW REAGENT BLANK
1000 PPB RDX	10	19:22	
METHOD BLANK RDX	11	19:24	
BLANK SPIKE RDX	12	19:26	
#100	13	19:28	
#101	14	19:30	
#102	15	19:32	
#103	16	19:34	
REAGENT BLANK TNT	17	20:11	Auto Zero w/ TNT Reagent Blank
MB TNT	18	20:13	
500 PPB TNT	19	20:16	
SB TNT	20	20:19	
#100 TNT	21	20:21	
#101 TNT	22	20:23	
#102 TNT	23	20:26	
#103 TNT	24	20:29	

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/14/93

	Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
STD #1	REAGENT BLANK	1	11:49	TNT ANALYSIS - AUTOZEROED
	500 PPB TNT	2	11:50	OK
	#104	3	11:54	AUTOZEROED BEFORE ANALYSIS
	#105	4	11:56	PORTION OF SAMPLE LOST DURING CD - REEXTRACT
	#106	5	11:58	
	#107	6	11:59	
	#108	7	12:02	VALUE ABOVE ~~#~~5000 PPB STD. SEE SAMPLE CALC. SHEET
	#109	8	12:04	
#1	REAGENT BLANK	9	13:38	RDX ANALYSIS
	500 PPB RDX	10	13:41	LOW - CONTINUE ANALYSIS
	#104	11	13:45	AUTOZEROED BEFORE ANALYSIS
	#105	12	13:49	AUTOZEROED BEFORE ANALYSIS - REEXTRACT
	#106	13	13:51	
	#107	14	13:52	
	#108	15	13:56	
	#109	16	13:58	
#2	REAGENT BLANK	17	15:44	TNT ANALYSIS
	500 PPB TNT	18	15:51	LOW CONTINUE ANALYSIS - ~~REANALYZE~~
	METHOD BLANK # 10/14	19	15:55	~~REANALYZE~~
	BLANK SPIKE 10/14	20	15:57	AUTOZERO BEFORE ANALYSIS ~~REANALYZE~~
	#110	21	15:59	AUTOZERO BEFORE ANALYSIS ~~REANALYZE~~
	#111	22	16:01	AUTOZERO BEFORE ANALYSIS - REANALYZE
	#111	23	16:05	REANALYZE
	#111	24	16:07	OK
	#112	25	16:11	
	#113	26	16:13	
	#114	27	16:15	
	#115	28	16:16	
	REAGENT BLANK	29	18:15	RDX ANALYSIS ~~AUTOZERO~~
#2	500 PPB RDX	30	18:16	RERUN
	500 PPB RDX	31	18:19	~~OK~~ RERUN
	500 PPB RDX	32	18:20	OK
	METHOD BLANK 10/14 RDX	33	18:22	
	BLANK SPIKE 10/14 RDX	34	18:24	
	#110	35	18:26	
	#111	36	18:28	
	#112	37	18:30	
	#113	38	18:31	
	#114	39	18:33	
	#115	40	18:34	
	REAGENT BLANK	41	20:07	AUTO ZERO TNT ANALYSIS.
#3	500 PPB TNT	42	20:10	
	#105	43	20:14	
	#116	44	20:17	
	117	45	20:20	
	118	46	20:23	
	119	47	20:26	
	120	48	20:28	
	120 SD	49	20:31	AUTO ZERO

UV

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/14/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
121	50	20:34	Auto Zero
~~122~~	~~50~~ 51	~~20:37~~	dmw 10/14/93
121	51 ~~51~~ *	20:41	
122	52	20:43	Auto Zero
122	53	20:44	
500 PPB ~~RDX~~ TNT	54	20:47	
REAGENT BLANK RDX	55	21:10	Auto Zero RDX Analysis
500 PPB RDX	56	21:16	
# 105	57	21:19	Auto Zero
# 116	58	21:21	
# 117	59	21:23	Auto Zero
# 118	60	21:24	
# 119	61	21:26	
# 120	62	21:28	
# 120SD	63	21:30	Auto Zero
121	64	21:31	
122	65	21:34	

dmw 10/14/93

UV
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DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/15/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
RB RDX Analyses	1	11:18	
100 ppb RDX	2	11:20	
250 ppb	3	11:21	
500 ppb	4	11:24	
1000 ppb	5	11:26	
5000 ppb	6	11:30	
~~100 ppb~~	~~7~~	~~11:35~~	
250 ppb	~~8~~ 7	11:42	
500 ppb	~~9~~ 8	11:44	
1000 ppb	~~10~~ 9	11:47	
5000 ppb	~~11~~ 10	11:49	
RB RDX Analysis	#11	13:05	Auto Zero
1000 ppb	#12	13:07	
5000 ppb	#13	13:10	
~~1,000 ppb~~	~~14~~	~~14:20~~	
RB RDX	~~15~~ 14	14:23	Auto Zero
5000 PPb	~~16~~ 15	14:24	
REAGENT Blank RDX	16	14:45	Auto Zero
500 PPb	17	14:50	USE FOR CONTINUING CAL.
250 PPb	18	14:53	DO NOT USE ANY OTHER STD
1000 PPb	19	14:58	Auto Zero FROM INITIAL CAL
5000 PPb	20	15:00	
REAGENT BLANK RDX ANAL.	21	16:37	Auto Zero
~~#123~~	~~22~~	~~16:40~~	
#124	~~23~~ 22	16:43	
#125	~~24~~ 23	16:46	
#123	24	16:52	
#126	25	16:55	
#127	26	16:57	
#128	27	16:59	
~~REAGENT BLANK TNT ANAL~~	~~28~~	~~17:57~~	~~Auto Zero~~
500 PPb TNT	28	18:02	
REAGENT BLANK TNT ANAL	29	18:03	
#123	30	18:05	
#124	31	18:09	Auto Zero
#125	32	18:11	
#126	33	18:14	
#127	34	18:16	Auto Zero
#128	35	18:19	
REAGENT BLANK TNT ANAL	36	20:12	Auto Zero
500 PPB TNT	37	20:14	
MB	38	20:19	Auto Zero
BS	39	20:21	
129	40	20:24	Auto Zero
130	41	20:25	
131	42	20:29	Auto Zero
~~132~~	~~43~~	~~20:29~~	
REAGENT BLANK RDX ANAL	43	21:02	
500 PPB	44	21:07	LOW ABSORBANCE READING - OBVIOUS COLOR DEVELOPED IN STANDARD -

TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 10/15/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
METHOD BLANK 10/15	45	21:12	
BLANK SPIKE 10/15	46	21:14	
#129	47	21:15	
#130	48	21:17	
#131	49	21:19	

DMW 10/15/93

TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 10/16/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	13:10	RDX ANALYSIS
500 PPB RDX	2	13:12	REPREP
#132	3	13:14	
#133	4	13:15	
#134	5	13:17	
#135	6	13:19	
#136	7	13:20	
#137	8	13:23	
#138	9	13:24	
#139	10	13:26	
#140	11	13:28	
#141	12	13:30	
#141 MS	~~12~~ 13	13:32	
~~500~~ 1000 PPB RDX	14	~~13~~14:40	REANALYZE
~~500~~ 1000 PPB RDX	15	1441	USE
REAGENT BLANK	16	15:14	TNT ANALYSIS
500 PPB TNT	17	15:15	
#132	18	15:22	
#133	19	15:24	
#134	20	15:27	AUTOZERO BEFORE ANALYSIS
#135	21	15:28	
REAGENT BLANK	22	1530	AUTOZERO
#136	23	15:39	
#137	24	15:43	
#138	25	15:45	
#139	26	15:46	
#140	27	15:48	
#141	28	15:52	
#141 MS	29	15:54	
REAGENT BLANK	30	18:08	RDX ANALYSIS
500 PPB RDX	31	18:09	
MB 10/16/93	32	18:11	
BS 10/16	33	18:13	
#142	34	18:14	
#143	35	18:16	
#144	36	18:20	AUTOZERO BEFORE ANALYSIS
#145	37	18:22	
#146	38	18:24	
#147	39	18:26	
#148	40	18:27	
#149	41	18:30	
#150	42	18:32	
REAGENT BLANK	43	~~18~~19:06	TNT ANALYSIS - AUTOZERO - NOT ANALYZED
500 PPB TNT	44	19.08	
BS #10/16	45	19:14	
MB 10/16	46	19:15	
#142	47	19:17	
#143	48	19:18	
#144	49	19:20	REANALYZE - CUVETTE DIRTY

UV

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/16/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
#144	50	19:20	
#145	51	19:22	
~~#146~~ #146	52	19:24	
~~#147~~ #148	53	19:25	
#147	54	19:27	
#149	55	19:29	
#150	56	19:30	

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DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/17/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	13:20	AUTOZERO BEFORE ANALYSIS - RDX ANALYSIS
500 PPB	2	13:21	
#151	3	13:22	
#152	4	13:24	
#153	5	13:25	
#154	6	13:27	
#155	7	13:29	
#156	8	13:~~30~~31	BEYOND CALIBRATION RANGE
#157	9	13:33	
#158	10	13:35	
#159	11	13:38	
#160	12	13:41	
#161	13	13:43	
REAGENT BLANK	14	15:09	TNT ANALYSIS - AUTOZERO BEFORE ANALYSIS
500 PPB	15	15:12	
#151	16	15:15	
#152	17	15:16	
#153	18	15:17	
#154	19	15:18	
#155	20	15:20	
#156	21	15:21	
#157	22	15:22	
#158	~~22~~23	15:23	
#159	24	15:25	
#160	25	15:26	
#161	26	15:27	
REAGENT BLANK	27	17:47	RDX ANALYSIS - AUTOZERO BEFORE ANALYSIS
500 PPB RDX	28	17:48	
~~REAGENT BLANK~~ MB 10/17	29	17:50	
BS 10/17	30	17:51	
#162	31	17:53	
#162 MS	32	17:55	
#163	33	17:56	
#164	34	17:57	
#165	35	17:59	
#166	36	18:00	
REAGENT BLANK	37	19:03	TNT ANALYSIS - AUTOZERO BEFORE ANALYSIS
500 PPB TNT	38	19:04	
MB 10/17	39	19:05	
BS 10/17	40	19:08	
#162	41	19:10	
#162 ~~SD~~ MS	42	19:11	
#163	43	19:13	
#164	44	19:14	
#165	45	19:16	
#166	46	19:18	
REAGENT BLANK TNT ANAL	47	20:02	
500PPB TNT	48	20:04	
#167	49	20:06	

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TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date :

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
#168	50	20:08	
#169	51	20:10	
#170	52	20:12	
#171	53	20:13	
#172	54	20:15	
#173	55	20:17	
#174	56	20:19	
#175	57	20:21	
REAGENT BLANK	58	20:38	RDX ANALYSIS - AUTOZERO BEFORE ANALYSIS
500 PPB RDX	59	20:40	DON'T USE FOR QUANTITATION - USE PREVIOUS STANDARD
#167	60	20:42	
#168	61	20:43	
#169	62	20:44	
#170	63	20:46	
#171	64	20:47	
#172	65	20:48	
#173	66	20:49	
#174	67	20:51	
#175	68	20:52	

[illegible] 10/17/93

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/18/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	15:48	RDX ANALYSIS
100 PPB RDX	2	15:54	
250 PPB RDX	3	15:58	NO COLOR DEVELOPMENT
500 PPB RDX	4	~~15~~ 16:00	FOR STANDARDS
1000 PPB RDX	5	16:01	
5000 PPB R	6	16:03	
REAGENT BLANK TNT	7	17:05	TNT ANALYSIS AUTOZERO
REAGENT BLANK	8	17:06	
500 PPB NEW	9	17:07	
500 PPB OLD	10	17:09	
MB 10/18	11	17:10	
BS 10/18	12	17:12	
176	13	17:15	
177	14	17:17	
179	15	17:18	AUTO ZERO
179	16	17:20	
180	17	17:22	AUTO ZERO
181	18	17:24	
182	19	17:26	
183	20	17:28	
183	21	17:28	
184	22	17:32	
185	23	17:34	
REAGENT BLANK	24	18:09	RDX ANALYSIS - RERUN
REAGENT BLANK	25	18:10	AUTOZERO
500 PPB STD	26	18:11	
MB 10/18	27	18:12	
BS 10/18	28	18:13	
#176	29	18:15	
#177	30	18:16	
#178	31	18:17	
~~#179~~ #179	32	18:18	
#180	33	18:26	
#181	34	18:27	
#182	35	18:29	
#183	36	18:31	AUTOZERO BEFORE ANALYSIS
#183 MS	37	18:32	
#184	38	18:34	
#185	39	18:35	

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TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 10/19/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK - CONTROL	1	12:00	RDX ANALYSIS
RB -1	2	12:02	
~~500 1A~~ 500 PPB-1A	3	12:03	
500 PPB-1B	4	12:05	
RB-2	5	12:07	
500 PPB-2A	6	12:09	
500 PPB-2B	7	12:11	
500 PPB	8	13:50	NEW STOCK UNFILTERED
REAGENT BLANK	9	16:46	TNT ANALYSIS AUTO ZERO
MB	10	16:48	
REAGENT BLANK	11	16:50	
MB	12	16:52	
TNT 500ppb	13	16:54	
BS	14	16:56	
BSD	15	16:58	
#186	16	17:01	
#187	17	17:03	
#188	18	17:05	
#189	19	17:07	
#190	20	17:09	
#191	21	17:11	
#192	22	17:13	
#193	23	17:14	
#194	24	17:16	
500PPB	25	17:32	~~AUTO ZERO BEFORE~~
REAGENT BLANK	26	18:29	RDX ANALYSIS AUTOZERO BEFORE ANALYSIS
MB 10/19	27	18:30	
BS 10/19	28	18:31	
BSD 10/19	29	18:33	
#186	30	18:34	
#187	31	18:36	
#188	32	18:37	
#189	33	18:38	
#190	34	18:39	
#191	35	18:41	
#192	36	18:42	
#193	37	18:43	
#194	38	18:44	

DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 10/27/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	14:42	RDX ANALYSIS - AUTOZERO BEFORE ANALYSIS
100 PPB RDX	2	14:43	
250 PPB RDX	3	14:47	POOR COLOR DEVELOPMENT
500 PPB RDX	4	14:49	
1000 PPB RDX	5	14:52	
5000 PPB RDX	6	14:53	
REAGENT BLANK	7	15:45	TNT ANALYSIS.
100 PPB	8	15:47	
250 PPB	9	15:49	
500 PPB	10	15:51	
1000 PPB	11	15:53	
5000 PPB	12	15:54.	
250 PPB RDX	13	16:13	RDX ANALYSIS - POOR COLOR DEVELOPMENT
1000 PPB RDX	14	16:16	POOR COLOR DEVELOPMENT
250 PPB RDX	15	17:56	USE FOR CURVE
1000 PPB RDX	16	17:58	↓

DAW 10/27/93

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DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 10/28/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK TNT	1	13:32	AUTO ZERO
500 PPB TNT	2	13:36	PARTICULATE MATTER IN MEDIUM
500 PPB TNT	3	13:52	" " " "
500 PPB TNT	4	13:53	USE FOR QUANTITATION
#1	5	13:57	REANALYZE
#2	6	13:59	
#3	7	14:01	
#195	8	14:03	
~~#5~~ #196	9	14:05	AUTO ZERO AFTER ANAL
#197	10	14:07	
#198	11	14:09	
#198SD	12	14:10	
REAGENT BLANK TNT	13	14:18	REANAL OF TNT
#198SD	14	14:19	
#1	15	14:22	
#2	16	14:24	AUTOZERO BEFORE
#3	17	14:26	
#195	18	14:29	
#196	19	14:31	
#197	20	14:33	
#198	21	14:34	
500 PPB TNT	22	14:37	
REAGENT BLANK RDX	23	15:59	RERUN ANALYZE
500 PPB RDX	24	16:00	
#1	25	16:02	
#2	26	16:04	DIDNT SWITCH TO RDX WAVELENGTH
#3	27	16:06	
# ~~#9~~ 195	28	16:08	
#196	29	16:10	
#197	30	16:12	
#198	31	16:14	AUTO ZERO AFTER
REAGENT BLANK RDX	32	16:16	RDX ANALYSIS
500 PPB RDX	33	16:19	
#1	34	16:21	
#2	35	16:23	
#3	36	16:24	
#195	37	16:26	
#19~~6~~7	38	16:28	
#196	39	16:29	
#198	40	16:31	RERUN
#198SD	41	16:33	
#198	42	16:35	
#198	43	16:39	
#198SD	44	16:42	
REAGENT BLANK RDX	45	18:14	RDX ANALYSIS
REAGENT BLANK RDX	46	18:14	
500 PPB RDX	47	18:16	
MB	48	18:18	
BS	49	18:20	

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DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/28/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
#4	50	18:22	
#5	51	18:24	
#6	52	18:26	
#7	53	18:28	Auto Zero After
#8	54	18:30	
#9	55	18:32	
REAGENT BLANK TNT	56	19:02	TNT ANALYSIS
500 ppb	57	19:04	
MB	58	19:06	
BS	59	19:09	
#4	60	19:10	
#5	61	19:12	
#6	62	19:13	
#7	63	19:15	
#8	64	19:17	
#9	65	19:18	

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TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 10/29/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT	1	12:05	TNT ANALYSIS - RERUN
REAGENT	2	12:09	AUTOZERO BEFORE ANALYSIS
500 PPB	3	12:10	
#10	4	12:16	
#11	5	12:17	
#12	6	12:18	
#13	7	12:19	
#14	8	12:21	
#15	9	12:22	
#16	10	12:24	AUTOZERO BEFORE ANALYSIS
#17	11	12:28	AUTOZERO BEFORE ANALYSIS
REAGENT BLANK	12	13:42	RDX ANALYSIS - AUTOZERO BEFORE ANALYSIS
500 PPB	13	13:44	
#10	14	13:51	
#11	15	13:52	
#12	16	13:58	
#13	17	13:59	
#14	18	14:00	
#15	19	14:01	
#16	20	14:03	
#17	21	14:04	
REAGENT BLANK	22	15:37	RDX ANALYSIS
REAGENT BLANK	23	15:37	AUTOZERO BEFORE ANALYSIS
500 PPB	24	15:42	
#18	25	15:43	
#19	26	15:46	
#20	27	15:47	
#21	28	15:48	
#21 MS	29	15:50	
#22	30	15:51	
#23	31	15:52	
#24	32	15:55	
REAGENT BLANK	33	16:47	TNT ANALYSIS
500 PPB	34	16:52	RERUN
500 PPB	35	16:52	
#18	36	16:53	
#19	37	16:54	
#20	38	16:55	
#21	39	16:56	
#21 MS	40	16:58	
#22	41	16:59	
#23	42	17:00	
#24	43	17:02	
REAGENT BLANK	44	18:04	TNT
500 PPB	45	18:06	
MB 10/29	46	18:07	
BS 10/29	47	18:09	
#25	48	18:10	
#26	49	18:11	

DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 10/29/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
#27	50	18:13	
#28	51	18:14	
#29	52	18:16	
#30	53	18:17	
REAGENT BLANK	54	19:18	RDX ANALYSIS
REAGENT BLANK	55	19:18	AUTOZERO BEFORE ANALYSIS
500 PPB	56	19:20	496 ug/L TRUE VALUE
MB 10/29	57	19:22	
BS 10/29	58	19:24	
#25	59	19:25	
#26	60	19:26	
#27	61	19:27	
#28	62	19:29	
#29	63	19:30	
#30	64	19:31	

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TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/30/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
BLANK REAGENT	1	12:53	TNT ANALYSIS
500 ppb TNT	2	12:56	T
#31	3	12:57	AUTO ZERO AFTER
#32	4	12:59	
#33	5	13:01	AUTO ZERO AFTER
#34	6	13:03	
#35	7	13:04	
#36	8	13:05	
#37	9	13:07	
#38	10	13:08	
REAGENT BLANK	11	14:25	AUTO ZERO AFTER
REAGENT BLANK	12	14:27	RDX ANALYSIS.
500 ppb RDX	13	14:27	
31	14	14:29	
32	15	14:31	
33	16	14:33	
34	17	14:34	
35	18	14:36	
36	19	14:37	
37	20	14:39	
38	21	14:41	
REAGENT BLANK	~~22~~	16:42	RDX - NOT ANALYZED
500 PPB RDX	~~23~~ 22	16:44	AUTO ZERO AFTER
MB	~~24~~ 23	16:45	
BS	~~25~~ 24	16:47	
#39	~~26~~ 25	16:49	
#40	~~27~~ 26	16:51	
#41	~~28~~ 27	16:52	
#42	~~29~~ 28	16:53	
#42ms	~~30~~ 29	16:54	
#43	~~31~~ 30	16:56	
REAGENT BLANK	~~32~~ 31	17:31	TNT
500 PPB	~~33~~ 32	17:33.	
MB	~~34~~ 33	17:37	
BS	~~35~~ 34	17:38	
39	~~36~~ 35	17:39	
40	~~37~~ 36	17:40	
41	~~38~~ 37	17:41	
42	~~39~~ 38	17:42	
42MS	~~40~~ 39	17:44	
43	~~41~~ 40	17:45	

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DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 10/31/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	12:24	TNT ANALYSIS
500 PPB	2	12:25	
#44	3	12:26	
#45	4	12:28	
#46	5	12:29	
#47	6	12:31	
#48	7	12:32	
#49	8	12:34	
#50	9	12:36	
#51	10	12:38	
REAGENT BLANK	11	14:00	RDX ANALYSIS
500 PPB	12	14:01	
#44	13	14:03	
#45	14	14:04	
#46 1:5	15	14:06	
#47	16	14:07	
#48	17	14:09	
#49 1:5	18	14:10	
# ~~50~~ 51	19	14:13	
#50	20	14:15	
REAGENT BLANK	21	15:44	
500 PPB	22	15:46	
#52 1:5	23	15:48	
#53	24	15:49	
#54	25	15:51	
#55 1:5	26	15:52	
#56	27	15:54	
#57	28	15:56	
#58 1:5	29	15:57	
#59	30	15:59	
REAGENT BLANK	31	16:44	TNT ANALYSIS
500 PPB	32	16:45	
#52	33	16:46	
#53	34	16:47	
#54	35	16:49	
#55	36	16:50	
#56	37	16:51	
#57	38	16:53	AUTOZERO BEFORE ANALYSIS
#58	39	16:55	
#59	40	16:56	
REAGENT BLANK	41	~~16~~ 17:11	
500 PPB	42	17:13	
MB 10/31	43	17:22	
BS 10/31	44	17:23	
#60	45	17:26	
#61	46	17:27	
#62	47	17:29	
#63	48	17:31	
#63 MS	49	17:32	

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DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily Analysis Log
UMDA

Date : 10/31/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
#64	50	17:35	
REAGENT BLANK	51	17:55	RDX ANALYSIS
500 PPB	52	17:56	
MB 10/31	53	17:58	
BS 10/31	54	17:59	
#60	55	18:01	
#61	56	18:03	
#62	57	18:05	
#63	58	18:08	
#63 MS	59	18:11	PROBLEM WITH COLOR DEVELOPMENT.
#64	60	18:15	

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DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 11/1/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	12:55	TNT ANALYSIS.
500 PPB	2	12:57	
#65	3	12:59	
#66	4	13:00	
#67	5	13:02	~~RE-ANAL~~
#67	6	13:04	RE-ANALYSIS OF #67
#68	7	13:05	AUTO ZERO AFTER
#69	8	13:07	
#70	9	13:10	
#71	10	13:12	
#72	11	13:14	
REAGENT BLANK	12	14:27	RDX ANALYSIS
500 PPB	13.	14:28	
65 ~~(5:1)(1:5)~~	14	14:30	
66	15	14:32	AUTO ZERO AFTER
67	16	14:34	
68 (1:5)	17	14:36	AUTO ZERO AFTER
69	18	14:39	
70	19	14:41	
71 (1:5)	20	14:42	
72	21	14:44	
REAGENT BLANK	22.	17:53	RDX ANALYSIS.
500 PPB	23	17:55	
#60	24.	17:57	
#61 (1:5)	25.	17:59	AUTO ZERO AFTER
#64	26.	18:03	
~~#73~~ 64	27	18:05	
~~#74~~ 73	28	18:07	
#74	29	18:10	AUTO ZERO AFTER
#75	30	18:12	
#76	31	18:14	AUTO ZERO Before
#77	32	18:16	AUTO ZERO Before
REAGENT BLANK	33	18:21	REANAL DIDNT Change Beem!
500 PPB	34	18:23	REANAL DIDNT Change Beam!
REAGENT BLANK	35	18:26	TNT ANALYSIS
500 PPB	36	18:26	AUTO ZERO
#73	37	18:27	
#74	38	18:29	
#75	39	18:31	
76	40	18:32	
77	41	18:34	AUTO ZERO Before

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TNT and RDX Field Screening Analysis

DAMES & MOORE

Daily Analysis Log

UMDA

Date : 11/2/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	12:06	TNT ANALYSIS
500 PPB	2	12:08	
#78	3	12:09	
#79	4	12:11	
#80	5	12:13	
#81	6	12:14	
#82	7	12:15	
#83	8	12:17	
#84	9	12:19	
#84 MS	10	12:21	
REAGENT BLANK	11	13:43	RDX ANALYSIS
500 PPB	12	13:45	
#78	13	13:47	
#79	14	13:48	
#80 1:5	15	13:49	
#81	16	13:51	
#82	17	13:53	
#83 1:5	18	13:55	
#84 1:5	19	13:57	
#84 MS 1:5	20	13:58	
REAGENT BLANK	21	15:48	
500 PPB	22	15:49	
MB 11/2	23	15:51	
BS 11/2	24	15:52	
#62	25	15:56	
#63	26	15:58	
#63 MS	27	15:59	
#85	28	16:01	
#86	29	16:03	
#87 1:5	30	16:05	
REAGENT BLANK	31	16:11	TNT ANALYSIS
500 PPB	32	16:13	
MB 11/2	33	16:14	
BS 11/2	34	16:16	
#85	35	16:17	
#86	36	16:19	
#87	37	16:21	

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DAMES & MOORE

TNT and RDX Field Screening Analysis

Daily Analysis Log

UMDA

Date : 11/3/93

Sample ID	Anal. No.	Analysis Time Hr : Min	Comments
REAGENT BLANK	1	12:35	TNT Analysis
TNT 500 ppb	2	12:40	CRYSTAL ON GLASS CUVETTE - REANALYSIS -
500 ppb	3	12:42	USE ANAL # 12
# ~~88~~ 89	4	12:44	
# 88	5	12:48	
# 90	6	12:52	AUTOZERO BEFORE
# 91	7	12:54	
# 92	8	12:56	
# 93	9	12:57	
# 94	10	12:59	
# 95	11	13:00	
500 ppb	12	13:28	
REAGENT BLANK	13	14:10	RDX ANALYSIS
500 ppb	14	14:11	
#88	15	14:13	
#89	16	14:14	
#90 (1.5)	17	14:16	
#91	18	14:18	
#92	19	14:20	
#93	20	14:22	
#94	21	14:23	
# 95	22	14:27	
REAGENT BLANK	23	15:59	TNT ANALYSIS
REAGENT BLANK	24	16:01	
500 ppb	25	16:02	
MB 11/3	26	16:03	
BS 11/3	27	16:05	
96	28	16:07	
~~87~~ 97	29	16:09	
~~88~~ 98	30	16:10	
~~89~~ 99	31	16:12	
99 MS	32	16:13	
REAGENT BLANK	33	16:24	TNT ANALYSIS
500 ppb	34	16:26	
~~MB 11/3~~ 500 ppb	35	16:27	
MB 11/3	36	16:28	
BS 11/3	37	16:29	
96	38	16:30	
97	39	16:34	
98	40	16:36	
99	41	16:38	
99 MS	42	16:42	

D.7 SAMPLE CALCULATION WORKSHEETS

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/11/93

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Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
MB 10/11	7	540	0.004	4.45E-05	1000	25	20	4.49	TNT ANALYSIS
BS#1 10/11	8	540	0.052	4.45E-05	1000	25	20	58.43	
BS#2 10/11	9	540	0.053	4.45E-05	1000	25	20	59.55	
SAMPLE#1	10	540	0.33	4.45E-05	1000	25	20	370.79	concentration beyond cal range
SAMPLE#1 MS	11	540	0.374	4.45E-05	1000	25	20	420.22	concentration beyond cal range
SAMPLE#1 MSD	12	540	0.309	4.45E-05	1000	25	20	347.19	concentration beyond cal range

* - taken from daily calibration standard

CF = Vi/Vf Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/12/93

UV
D-76

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
MB 10/12	16	540	0.001	4.05E-05	1000	25	20	1.23	TNT ANALYSIS
BS 10/12	17	540	0.015	4.05E-05	1000	25	20	18.52	
4 - 1	18	540	0.159	4.05E-05	50	25	1	3925.93	
4 -1 dup	19	540	0.148	4.05E-05	50	25	1	3654.32	
4 -1 MS	20	540	0.169	4.05E-05	50	25	1	4172.84	
4 - 1 MSD	21	540	0.168	4.05E-05	50	25	1	4148.15	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis

Sample Calculation Worksheet

UMDA

Date : 10/13/93

UV D-77

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
MB RDX 10/13	11	507	-0.001	2.42E-05	1000	25	20	-2.07	RDX analysis
BS RDX 10/13	12	507	0.019	2.42E-05	1000	25	20	39.26	
#100	13	507	0.062	2.42E-05	50	25	1	2561.98	
#101	14	507	0.06	2.42E-05	50	25	1	2479.34	
#102	15	507	0.041	2.42E-05	1000	25	20	84.71	
#103	16	507	-0.001	2.42E-05	1000	25	20	-2.07	
MB TNT 10/13	18	540	0.001	3.85E-05	1000	25	20	1.30	TNT analysis
BS TNT 10/13	20	540	0.014	3.85E-05	1000	25	20	18.18	
#100	21	540	0.15	3.85E-05	50	25	1	3896.10	
#101	22	540	0.123	3.85E-05	50	25	1	3194.81	
#102	23	540	0.035	3.85E-05	1000	25	20	45.45	
#103	24	540	-0.011	3.85E-05	1000	25	20	-14.29	

* - taken from daily calibration standard

CF = Vi/Vf Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/14/93

UV D-78

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#104	3	540	0.142	4.25E-05	50	25	1	3341.2	TNT analysis
#105	4	540	0.043	4.25E-05	1000	25	20	50.6	portion of extract lost - reextract
#106	5	540	-0.002	4.25E-05	1000	25	20	-2.4	below MDL
#107	6	540	0.136	4.25E-05	50	25	1	3200.0	
#108	7	540	0.258	4.25E-05	1000	25	20	303.5	
#109	8	540	-0.002	4.25E-05	1000	25	20	-2.4	below MDL
#104	11	507	0.099	2.42E-05	50	25	1	4090.9	RDX analysis
#105	12	507	0.003	2.42E-05	1000	25	20	6.2	lost portion of extract - reextract
#106	13	507	0.215	2.42E-05	1000	25	20	444.2	
#107	14	507	0.094	2.42E-05	50	25	1	3884.3	
#108	15	507	0.036	2.42E-05	1000	25	20	74.4	
#109	16	507	0.043	2.42E-05	1000	25	20	88.8	
MB 10/14	19	540	-0.003	3.44E-05	1000	25	20	-4.4	below MDL - TNT
BS 10/14	20	540	0.007	3.44E-05	1000	25	20	10.2	
#110	21	540	0.118	3.44E-05	50	25	1	3430.2	
#111	24	540	0.004	3.44E-05	1000	25	20	5.8	
#112	25	540	-0.002	3.44E-05	1000	25	20	-2.9	below MDL
#113	26	540	0.122	3.44E-05	50	25	1	3546.5	
#114	27	540	0.019	3.44E-05	1000	25	20	27.6	
#115	28	540	-0.006	3.44E-05	1000	25	20	-8.7	below MDL
MB 10/14	33	507	-0.001	3.02E-05	1000	25	20	-1.7	below MDL RDX
BS 10/14	34	507	0.028	3.02E-05	1000	25	20	46.4	
#110	35	507	0.059	3.02E-05	50	25	1	1953.6	
#111	36	507	-0.001	3.02E-05	1000	25	20	-1.7	below MDL
#112	37	507	0	3.02E-05	1000	25	20	0.0	below MDL
#113	38	507	0.055	3.02E-05	50	25	1	1821.2	
#114	39	507	0.002	3.02E-05	1000	25	20	3.3	below MDL

* - taken from daily calibration standard

CF = Vi/Vf Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA
Date : 10/14/93

UV D-79

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#115	40	507	-0.003	3.02E-05	1000	25	20	-5.0	below MDL - RDX analysis
#105	43	540	0.112	3.85E-05	1000	25	20	145.5	TNT analysis
#116	44	540	0.131	3.85E-05	50	25	1	3402.6	
#117	45	540	0.156	3.85E-05	1000	25	20	202.6	
#118	46	540	-0.003	3.85E-05	1000	25	20	-3.9	below method detection limit
#119	47	540	0.118	3.85E-05	50	25	1	3064.9	
#120	48	540	0.125	3.85E-05	50	25	1	3246.8	duplicate sample of #119
#120 MS	49	540	0.138	3.85E-05	50	25	1	3584.4	matrix spike of #119
#121	51	540	-0.007	3.85E-05	1000	25	20	-9.1	below method detection limit
#122	53	540	-0.012	3.85E-05	1000	25	20	-15.6	below method detection limit
#105	57	507	0.002	2.02E-05	1000	25	20	5.0	RDX analysis
#116	58	507	0.062	2.02E-05	50	25	1	3069.3	
#117	59	507	0.009	2.02E-05	1000	25	20	22.3	
#118	60	507	0.021	2.02E-05	1000	25	20	52.0	
#119	61	507	0.05	2.02E-05	50	25	1	2475.2	
#120	62	507	0.038	2.02E-05	50	25	1	1881.2	duplicate sample of #119
#120 MS	63	507	0.029	2.02E-05	50	25	1	1435.6	matrix spike of #119
#121	64	507	0.001	2.02E-05	1000	25	20	2.5	below method detection limit
#122	65	507	0.012	2.02E-05	1000	25	20	29.7	

* - taken from daily calibration standard

$CF = Vi/Vf$ $Cs = As/RF/CF$

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/15/93

UV D-80

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#123	24	507	0.064	2.82E-05	50	25	1	2269.5	RDX analysis
#124	22	507	0	2.82E-05	1000	25	20	0.0	below MDL
#125	23	507	0.003	2.82E-05	1000	25	20	5.3	
#126	25	507	0.08	2.82E-05	50	25	1	2836.9	
#127	26	507	0.004	2.82E-05	1000	25	20	7.1	
#128	27	507	0	2.82E-05	1000	25	20	0.0	below MDL
#123	30	540	0.103	2.83E-05	50	25	1	3639.6	TNT analysis
#124	31	540	0.026	2.83E-05	1000	25	20	45.9	
#125	32	540	-0.026	2.83E-05	1000	25	20	-45.9	below MDL
#126	33	540	0.091	2.83E-05	50	25	1	3215.5	
#127	34	540	0.066	2.83E-05	1000	25	20	116.6	
#128	35	540	-0.032	2.83E-05	1000	25	20	-56.5	below MDL
MB 10/15	38	540	-0.001	4.25E-05	1000	25	20	-1.2	below MDL
BS 10/15	39	540	0.016	4.25E-05	1000	25	20	18.8	
#129	40	540	0.156	4.25E-05	50	25	1	3670.6	
#130	41	540	0.028	4.25E-05	1000	25	20	32.9	
#131	42	540	-0.008	4.25E-05	1000	25	20	-9.4	below MDL
MB 10/15	45	507	-0.003	2.82E-05	1000	25	20	-5.3	RDX analysis - below MDL
BS 10/15	46	507	0.008	2.82E-05	1000	25	20	14.2	
#129	47	507	0.019	2.82E-05	50	25	1	673.8	
#130	48	507	-0.003	2.82E-05	1000	25	20	-5.3	below MDL
#131	49	507	0	2.82E-05	1000	25	20	0.0	below MDL

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/16/93

UV D-81

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#132	3	507	0.119	3.53E-05	50	25	1	3371.1	RDX analysis
#133	4	507	0	3.53E-05	1000	25	20	0.0	below MDL
#134	5	507	0	3.53E-05	1000	25	20	0.0	below MDL
#135	6	507	0.041	3.53E-05	50	25	1	1161.5	
#136	7	507	0.019	3.53E-05	1000	25	20	26.9	
#137	8	507	0	3.53E-05	1000	25	20	0.0	below MDL
#138	9	507	0.032	3.53E-05	50	25	1	906.5	
#139	10	507	0	3.53E-05	1000	25	20	0.0	below MDL
#140	11	507	0.025	3.53E-05	1000	25	20	35.4	
#141	12	507	0.008	3.53E-05	1000	25	20	11.3	
#141 MS	13	507	0.422	3.53E-05	1000	25	20	597.7	
#132	18	540	0.148	4.25E-05	50	25	1	3482.4	TNT analysis
#133	19	540	0.005	4.25E-05	1000	25	20	5.9	
#134	20	540	-0.001	4.25E-05	1000	25	20	-1.2	below MDL
#135	21	540	0.133	4.25E-05	50	25	1	3129.4	
#136	23	540	0.137	4.25E-05	1000	25	20	161.2	
#137	24	540	-0.006	4.25E-05	1000	25	20	-7.1	below MDL
#138	25	540	0.129	4.25E-05	50	25	1	3035.3	
#139	26	540	0.032	4.25E-05	1000	25	20	37.6	
#140	27	540	-0.007	4.25E-05	1000	25	20	-8.2	below MDL
#141	28	540	0	4.25E-05	1000	25	20	0.0	below MDL
#141 MS	29	540	0.012	4.25E-05	1000	25	20	14.1	
MB 10/16	32	507	-0.002	3.23E-05	1000	25	20	-3.1	RDX analysis - below MDL
BS 10/16	33	507	0.017	3.23E-05	1000	25	20	26.3	
#142	34	507	0.058	3.23E-05	50	25	1	1795.7	
#143	35	507	-0.002	3.23E-05	1000	25	20	-3.1	below MDL
#144	36	507	0.007	3.23E-05	1000	25	20	10.8	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/16/93

UV
D-82

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#145	37	507	0.04	3.23E-05	50	25	1	1238.4	RDX analysis
#146	38	507	0.006	3.23E-05	1000	25	20	9.3	
#147	39	507	0.019	3.23E-05	1000	25	20	29.4	
#148	40	507	0.113	3.23E-05	50	25	1	3498.5	
#149	41	507	0	3.23E-05	1000	25	20	0.0	below MDL
#150	42	507	0	3.23E-05	1000	25	20	0.0	below MDL
MB 10/16	46	540	0	3.04E-05	1000	25	20	0.0	TNT analysis - below MDL
BS 10/16	45	540	0.016	3.04E-05	1000	25	20	26.3	
#142	47	540	0.136	3.04E-05	50	25	1	4473.7	
#143	48	540	0	3.04E-05	1000	25	20	0.0	below MDL
#144	50	540	0	3.04E-05	1000	25	20	0.0	below MDL
#145	51	540	0.113	3.04E-05	50	25	1	3717.1	
#146	52	540	0.042	3.04E-05	1000	25	20	69.1	
#147	54	540	0.002	3.04E-05	1000	25	20	3.3	below MDL
#148	53	540	0.137	3.04E-05	50	25	1	4506.6	
#149	55	540	-0.001	3.04E-05	1000	25	20	-1.6	below MDL
#150	56	540	-0.001	3.04E-05	1000	25	20	-1.6	below MDL

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/17/93

UV D-83

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#151	3	507	0.07	2.82E-05	50	25	1	2482.3	RDX analysis
#152	4	507	0.01	2.82E-05	1000	25	20	17.7	
#153	5	507	0.006	2.82E-05	1000	25	20	10.6	
#154	6	507	0.043	2.82E-05	50	25	1	1524.8	
#155	7	507	0.036	2.82E-05	1000	25	20	63.8	
#156	8	507	0.659	2.82E-05	1000	25	20	1168.4	
#157	9	507	0.071	2.82E-05	50	25	1	2517.7	
#158	10	507	0.006	2.82E-05	1000	25	20	10.6	
#159	11	507	0.175	2.82E-05	1000	25	20	310.3	
#160	12	507	0.109	2.82E-05	50	25	1	3865.2	
#161	13	507	0.009	2.82E-05	1000	25	20	16.0	
#151	16	540	0.146	3.44E-05	50	25	1	4244.2	TNT analysis
#152	17	540	0	3.44E-05	1000	25	20	0.0	below MDL
#153	18	540	0.001	3.44E-05	1000	25	20	1.5	below MDL
#154	19	540	0.133	3.44E-05	50	25	1	3866.3	
#155	20	540	0.042	3.44E-05	1000	25	20	61.0	
#156	21	540	0.001	3.44E-05	1000	25	20	1.5	below MDL
#157	22	540	0.103	3.44E-05	50	25	1	2994.2	
#158	23	540	0.052	3.44E-05	1000	25	20	75.6	
#159	24	540	0	3.44E-05	1000	25	20	0.0	below MDL
#160	25	540	0.149	3.44E-05	50	25	1	4331.4	
#161	26	540	0.047	3.44E-05	1000	25	20	68.3	
MB 10/17	29	507	-0.002	3.43E-05	1000	25	20	-2.9	RDX analysis - below MDL
BS 10/17	30	507	0.014	3.43E-05	1000	25	20	20.4	
#162	31	507	-0.001	3.43E-05	1000	25	20	-1.5	below MDL
#162 MS	32	507	0.004	3.43E-05	1000	25	20	5.8	
#163	33	507	0.001	3.43E-05	1000	25	20	1.5	below MDL

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/17/93

UV
D-84

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#164	34	507	0.066	3.43E-05	50	25	1	1924.2	RDX analysis
#165	35	507	0.02	3.43E-05	1000	25	20	29.2	
#166	36	507	0.004	3.43E-05	1000	25	20	5.8	
MB 10/17	39	540	0	4.05E-05	1000	25	20	0.0	TNT analysis - below MDL
BS 10/17	40	540	0.016	4.05E-05	1000	25	20	19.8	
#162	41	540	0.076	4.05E-05	1000	25	20	93.8	
#162 MS	42	540	0.098	4.05E-05	1000	25	20	121.0	
#163	43	540	0.001	4.05E-05	1000	25	20	1.2	below MDL
#164	44	540	0.16	4.05E-05	50	25	1	3950.6	
#165	45	540	0.258	4.05E-05	1000	25	20	318.5	
#166	46	540	-0.001	4.05E-05	1000	25	20	-1.2	below MDL
#167	49	540	0.176	5.26E-05	50	25	1	3346.0	
#168	50	540	0.038	5.26E-05	1000	25	20	36.1	
#169	51	540	0.001	5.26E-05	1000	25	20	1.0	below MDL
#170	52	540	0.129	5.26E-05	50	25	1	2452.5	
#171	53	540	0.042	5.26E-05	1000	25	20	39.9	
#172	54	540	-0.001	5.26E-05	1000	25	20	-1.0	below MDL
#173	55	540	0.159	5.26E-05	50	25	1	3022.8	
#174	56	540	0.133	5.26E-05	1000	25	20	126.4	
#175	57	540	0.001	5.26E-05	1000	25	20	1.0	below MDL
#167	60	507	0.089	3.43E-05	50	25	1	2594.8	RDX analysis
#168	61	507	0.006	3.43E-05	1000	25	20	8.7	
#169	62	507	0.363	3.43E-05	1000	25	20	529.2	
#170	63	507	0.057	3.43E-05	50	25	1	1661.8	
#171	64	507	0.006	3.43E-05	1000	25	20	8.7	
#172	65	507	0.004	3.43E-05	1000	25	20	5.8	
#173	66	507	0.063	3.43E-05	50	25	1	1836.7	

* - taken from daily calibration standard

CF = Vi/Vf　　　Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/17/93

UV
D-85

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#174	67	507	0.012	3.43E-05	1000	25	20	17.5	
#175	68	507	0.036	3.43E-05	1000	25	20	52.5	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date: October 18, 1993

UV D-86

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
RB 101893 TNT	7	540	0.001	2.82E-05	1000	25	20	1.77	TNT analysis - below MDL
RB 101893 TNT	8	540	0	2.82E-05	1000	25	20	0.00	below MDL
MB 101893 TNT	11	540	-0.007	2.82E-05	1000	25	20	-12.41	below MDL
BS 101893 TNT	12	540	0.01	2.82E-05	1000	25	20	17.73	
#176	13	540	0.131	2.82E-05	50	25	1	4645.39	
#177	14	540	0.005	2.82E-05	1000	25	20	8.87	
#178	15	540	-0.007	2.82E-05	1000	25	20	-12.41	below MDL
#179	16	540	0.172	2.82E-05	50	25	1	6099.29	
#180	17	540	0.016	2.82E-05	1000	25	20	28.37	
#181	18	540	-0.001	2.82E-05	1000	25	20	-1.77	below MDL
#182	19	540	0.098	2.82E-05	50	25	1	3475.18	
#183	20	540	0.109	3.44E-05	50	25	1	3168.60	
#183SD	21	540	0.178	3.44E-05	50	25	1	5174.42	
#184	22	540	0.034	3.44E-05	1000	25	20	49.42	
#185	23	540	-0.004	3.44E-05	1000	25	20	-5.81	below MDL
RB 101893 RDX	24	507	0.001	3.44E-05	1000	25	20	1.45	RDX analysis - below MDL
RB 101893 RDX	25	507	0	3.44E-05	1000	25	20	0.00	below MDL
MB 101893 RDX	27	507	0.004	3.44E-05	1000	25	20	5.81	
BS 101893 RDX	28	507	0.036	3.44E-05	1000	25	20	52.33	
#176	29	507	0.075	3.44E-05	50	25	1	2180.23	
#177	30	507	0.006	3.44E-05	1000	25	20	8.72	
#178	31	507	0.007	3.43E-05	1000	25	20	10.20	
#179	32	507	0.154	3.43E-05	50	25	1	4489.80	
#180	33	507	0.009	3.43E-05	1000	25	20	13.12	
#181	34	507	0.074	3.43E-05	1000	25	20	107.87	
#182	35	507	0.192	3.43E-05	50	25	1	5597.67	
#183	36	507	0.097	3.43E-05	50	25	1	2827.99	Auto Zero
#183SD	37	507	0.148	3.43E-05	50	25	1	4314.87	
#184	38	507	0.016	3.43E-05	1000	25	20	23.32	
#185	39	507	0.011	3.43E-05	1000	25	20	16.03	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date: October 19, 1993

UV D-87

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
RB 101993 TNT	9	540	-0.001	2.82E-05	1000	25	20	-1.77	TNT analysis - below MDL
MB 101993 TNT	10	540	0	2.82E-05	1000	25	20	0.00	below MDL
RB 101993 TNT	11	540	0	2.82E-05	1000	25	20	0.00	below MDL
MB 101993 TNT	12	540	0.003	2.82E-05	1000	25	20	5.32	
BS TNT	14	540	0.012	2.82E-05	1000	25	20	21.28	
BSD TNT	15	540	0.021	2.82E-05	1000	25	20	37.23	
#186	16	540	0.158	2.82E-05	50	25	1	5602.84	
#187	17	540	0.158	2.82E-05	1000	25	20	280.14	
#188	18	540	-0.002	2.82E-05	1000	25	20	-3.55	below MDL
#189	19	540	0.115	2.82E-05	50	25	1	4078.01	
#190	20	540	0.174	2.82E-05	1000	25	20	308.51	
#191	21	540	-0.002	3.44E-05	1000	25	20	-2.91	below MDL
#192	22	540	0.239	3.44E-05	50	25	1	6947.67	
#193	23	540	0.56	3.44E-05	1000	25	20	813.95	
#194	24	540	-0.005	3.44E-05	1000	25	20	-7.27	below MDL
RB 101993 RDX	26	507	0	3.44E-05	1000	25	20	0.00	RDX analysis - below MDL
MB 101993 RDX	27	507	0	3.44E-05	1000	25	20	0.00	below MDL
BS	28	507	0.01	3.44E-05	1000	25	20	14.53	
BSD	29	507	0.021	3.44E-05	1000	25	20	30.52	
#186	30	507	0.064	3.44E-05	50	25	1	1860.47	
#187	31	507	0.083	3.44E-05	1000	25	20	120.64	
#188	32	507	0.002	3.43E-05	1000	25	20	2.92	below MDL
#189	33	507	0.058	3.43E-05	50	25	1	1690.96	
#190	34	507	0.081	3.43E-05	1000	25	20	118.08	
#191	35	507	0.005	3.43E-05	1000	25	20	7.29	
#192	36	507	0.063	3.43E-05	50	25	1	1836.73	
#193	37	507	0.114	3.43E-05	1000	25	20	166.18	
#194	38	507	0	3.43E-05	1000	25	20	0.00	below MDL

* - taken from daily calibration standard

CF = Vi/Vf Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/28/93

UV D-88

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#195	18	540	0.134	4.58E-05	50	25	1	2925.76	TNT analysis
#196	19	540	0.185	4.58E-05	1000	25	20	201.97	
#197	20	540	-0.003	4.58E-05	1000	25	20	-3.28	below MDL
#198	21	540	-0.003	4.58E-05	1000	25	20	-3.28	below MDL
#198 MS	14	540	0.013	4.58E-05	1000	25	20	14.19	
#1	15	540	0.037	4.58E-05	1000	25	20	40.39	
#2	16	540	0.022	4.58E-05	1000	25	20	24.02	
#3	17	540	0.016	4.58E-05	1000	25	20	17.47	
#195	37	507	0.093	3.54E-05	50	25	1	2627.12	RDX analysis
#196	39	507	-0.004	3.54E-05	1000	25	20	-5.65	below MDL
#197	38	507	0.007	3.54E-05	1000	25	20	9.89	
#198	43	507	0.003	3.54E-05	1000	25	20	4.24	below MDL
#198 MS	44	507	0.021	3.54E-05	1000	25	20	29.66	
#1	34	507	0.028	3.54E-05	1000	25	0.2	3954.80	
#2	35	507	0.004	3.54E-05	1000	25	0.2	564.97	
#3	36	507	-0.001	3.54E-05	1000	25	20	-1.41	below MDL
MB 10/28	48	507	0	4.10E-05	1000	25	20	0.00	below MDL
BS 10/28	49	507	0.02	4.10E-05	1000	25	20	24.39	
#4	50	507	0.004	4.10E-05	1000	25	20	4.88	below MDL
#5	51	507	0.204	4.10E-05	250	25	1	4975.61	
#6	52	507	-0.004	4.10E-05	1000	25	20	-4.88	below MDL
#7	53	507	-0.005	4.10E-05	1000	25	20	-6.10	below MDL
#8	54	507	0.112	4.10E-05	250	25	1	2731.71	
#9	55	507	-0.003	4.10E-05	1000	25	20	-3.66	below MDL
MB 10/28	58	540	0.001	4.38E-05	1000	25	20	1.14	TNT analysis - below MDL
BS 10/28	59	540	0.019	4.38E-05	1000	25	20	21.69	
#4	60	540	0	4.38E-05	1000	25	20	0.00	below MDL

* - taken from daily calibration standard

$CF = Vi/Vf$ $Cs = As/RF/CF$

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/28/93

UV
D-89

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#5	61	540	0.004	4.38E-05	250	25	1	91.32	
#6	62	540	0.006	4.38E-05	1000	25	20	6.85	
#7	63	540	-0.001	4.38E-05	1000	25	20	-1.14	below MDL
#8	64	540	0.003	4.38E-05	250	25	1	68.49	
#9	65	540	0.035	4.38E-05	1000	25	20	39.95	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/29/93

UV
D-90

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#10	4	540	0	4.18E-05	1000	25	20	0.00	TNT Analysis - below MDL
#11	5	540	0.004	4.18E-05	250	25	5	19.14	
#12	6	540	0	4.18E-05	1000	25	20	0.00	below MDL
#13	7	540	-0.001	4.18E-05	1000	25	20	-1.20	below MDL
#14	8	540	0.004	4.18E-05	250	25	5	19.14	
#15	9	540	0.01	4.18E-05	1000	25	20	11.96	
#16	10	540	-0.002	4.18E-05	1000	25	20	-2.39	below MDL
#17	11	540	0.005	4.18E-05	250	25	5	23.92	
#10	14	507	0.019	1.86E-05	1000	25	20	51.08	RDX Analysis
#11	15	507	0.25	1.86E-05	250	25	5	2688.17	
#12	16	507	-0.001	1.86E-05	1000	25	20	-2.69	below MDL
#13	17	507	0.009	1.86E-05	1000	25	20	24.19	
#14	18	507	0.23	1.86E-05	250	25	5	2473.12	
#15	19	507	-0.004	1.86E-05	1000	25	20	-10.75	below MDL
#16	20	507	-0.001	1.86E-05	1000	25	20	-2.69	below MDL
#17	21	507	0.097	1.86E-05	250	25	5	1043.01	
#18	25	507	0.006	3.72E-05	1000	25	20	8.06	RDX Analysis
#19	26	507	0.001	3.72E-05	1000	25	20	1.34	below MDL
#20	27	507	0.319	3.72E-05	250	25	5	1715.05	
#21	28	507	0.37	3.72E-05	250	25	5	1989.25	
#21MS	29	507	0.41	3.72E-05	250	25	5	2204.30	
#22	30	507	0.001	3.72E-05	1000	25	20	1.34	below MDL
#23	31	507	1.062	3.72E-05	1000	25	20	1427.42	
#24	32	507	0.224	3.72E-05	250	25	5	1204.30	
#18	36	540	0.018	3.78E-05	1000	25	20	23.81	TNT Analysis
#19	37	540	0	3.78E-05	1000	25	20	0.00	below MDL
#20	38	540	0.005	3.78E-05	250	25	5	26.46	

* - taken from daily calibration standard

CF = Vi/Vf

Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/29/93

UV D-91

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#21	39	540	0.004	3.78E-05	250	25	5	21.16	
#21MS	40	540	0.009	3.78E-05	250	25	5	47.62	
#22	41	540	0.001	3.78E-05	1000	25	20	1.32	below MDL
#23	42	540	-0.001	3.78E-05	1000	25	20	-1.32	below MDL
#24	43	540	0.004	3.78E-05	250	25	5	21.16	
MB TNT 10/29	46	540	0	4.98E-05	1000	25	20	0.00	TNT Analysis - below MDL
BS TNT 10/29	47	540	0.019	4.98E-05	1000	25	20	19.08	
#25	48	540	0.003	4.98E-05	1000	25	20	3.01	below MDL
#26	49	540	-0.001	4.98E-05	1000	25	20	-1.00	below MDL
#27	50	540	0.005	4.98E-05	250	25	5	20.08	
#28	51	540	0.015	4.98E-05	1000	25	20	15.06	
#29	52	540	-0.001	4.98E-05	1000	25	20	-1.00	below MDL
#30	53	540	0.005	4.98E-05	250	25	5	20.08	
MB RDX 10/29	57	507	0.002	2.82E-05	1000	25	20	3.55	RDX Analysis - below MDL
BS RDX 10/29	58	507	0.046	2.82E-05	1000	25	20	81.56	
#25	59	507	0.001	2.82E-05	1000	25	20	1.77	below MDL
#26	60	507	0.006	2.82E-05	1000	25	20	10.64	
#27	61	507	0.458	2.82E-05	250	25	5	3248.23	
#28	62	507	0.003	2.82E-05	1000	25	20	5.32	below MDL
#29	63	507	0.006	2.82E-05	1000	25	20	10.64	
#30	64	507	0.678	2.82E-05	250	25	5	4808.51	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/30/93

UV D-92

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#31	3	540	-0.001	4.38E-05	1000	25	20	-1.14	TNT analysis - below MDL
#32	4	540	0	4.38E-05	1000	25	20	0.00	below MDL
#33	5	540	0.004	4.38E-05	250	25	5	18.26	
#34	6	540	0	4.38E-05	1000	25	20	0.00	below MDL
#35	7	540	-0.001	4.38E-05	1000	25	20	-1.14	below MDL
#36	8	540	0.002	4.38E-05	250	25	5	9.13	
#37	9	540	0.007	4.38E-05	1000	25	20	7.99	
#38	10	540	-0.001	4.38E-05	1000	25	20	-1.14	below MDL
#31	14	507	0.007	3.17E-05	1000	25	20	11.04	RDX analysis
#32	15	507	0.037	3.17E-05	1000	25	20	58.36	
#33	16	507	1.18	3.17E-05	250	25	5	7444.79	
#34	17	507	0.005	3.17E-05	1000	25	20	7.89	
#35	18	507	0.002	3.17E-05	1000	25	20	3.15	below MDL
#36	19	507	1.124	3.17E-05	250	25	5	7091.48	
#37	20	507	-0.001	3.17E-05	1000	25	20	-1.58	below MDL
#38	21	507	0	3.17E-05	1000	25	20	0.00	below MDL
MB 10/30	23	507	0	3.17E-05	1000	25	20	0.00	below MDL
BS 10/30	24	507	0.028	3.17E-05	1000	25	20	44.16	
#39	25	507	0.94	3.17E-05	250	25	5	5930.60	
#40	26	507	0.005	3.17E-05	1000	25	20	7.89	
#41	27	507	0.007	3.17E-05	1000	25	20	11.04	
#42	28	507	0.004	3.17E-05	1000	25	20	6.31	
#42 MS	29	507	0.036	3.17E-05	1000	25	20	56.78	
#43	30	507	0.894	3.17E-05	250	25	5	5640.38	
MB 10/30	33	540	0.002	4.98E-05	1000	25	20	2.01	TNT analysis - below MDL
BS 10/30	34	540	0.02	4.98E-05	1000	25	20	20.08	
#39	35	540	0.004	4.98E-05	250	25	5	16.06	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/30/93

UV D-93

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#40	36	540	0	4.98E-05	1000	25	20	0.00	below MDL;
#41	37	540	0.001	4.98E-05	1000	25	20	1.00	below MDL
#42	38	540	0	4.98E-05	1000	25	20	0.00	below MDL
#42 MS	39	540	0.018	4.98E-05	1000	25	20	18.07	
#43	40	540	0.005	4.98E-05	250	25	5	20.08	

* - taken from daily calibration standard

CF = Vi/Vf

Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/31/93

UV D-94

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#44	3	540	0.001	4.38E-05	1000	25	20	1.14	TNT analysis- Below MDL
#45	4	540	0.001	4.38E-05	1000	25	20	1.14	Below MDL
#46	5	540	0.006	4.38E-05	250	25	5	27.40	
#47	6	540	0.006	4.38E-05	1000	25	20	6.85	
#48	7	540	0	4.38E-05	1000	25	20	0.00	Below MDL
#49	8	540	0.005	4.38E-05	250	25	5	22.83	
#50	9	540	-0.001	4.38E-05	1000	25	20	-1.14	Below MDL
#51	10	540	-0.001	4.38E-05	1000	25	20	-1.14	Below MDL
#44	13	507	0.004	2.98E-05	1000	25	20	6.71	RDX analysis
#45	14	507	0.166	2.98E-05	1000	25	20	278.52	
#46	15	507	0.212	2.98E-05	250	25	1	7114.09	
#47	16	507	0.01	2.98E-05	1000	25	20	16.78	
#48	17	507	0.005	2.98E-05	1000	25	20	8.39	
#49	18	507	0.256	2.98E-05	250	25	1	8590.60	
#51	19	507	0.016	2.98E-05	1000	25	20	26.85	
#50	20	507	0.106	2.98E-05	1000	25	20	177.85	
#52	23	507	0.176	1.86E-05	250	25	1	9462.37	RDX analysis
#53	24	507	1.394	1.86E-05	1000	25	20	3747.31	
#54	25	507	0.01	1.86E-05	1000	25	20	26.88	
#55	26	507	0.178	1.86E-05	250	25	1	9569.89	
#56	27	507	0.021	1.86E-05	1000	25	20	56.45	
#57	28	507	0.005	1.86E-05	1000	25	20	13.44	
#58	29	507	0.206	1.86E-05	250	25	1	11075.27	
#59	30	507	0.012	1.86E-05	1000	25	20	32.26	
#52	33	540	0.004	4.18E-05	250	25	5	19.14	TNT analysis
#53	34	540	0	4.18E-05	1000	25	20	0.00	Below MDL
#54	35	540	0	4.18E-05	1000	25	20	0.00	Below MDL

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

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DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA
Date : 10/31/93

UV D-95

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#55	36	540	0.005	4.18E-05	250	25	5	23.92	
#56	37	540	0	4.18E-05	1000	25	20	0.00	Below MDL
#57	38	540	0	4.18E-05	1000	25	20	0.00	Below MDL
#58	39	540	0.005	4.18E-05	250	25	5	23.92	
#59	40	540	0.015	4.18E-05	1000	25	20	17.94	
MB 10/31	43	540	0.002	4.18E-05	1000	25	20	2.39	TNT analysis-Below MDL
BS 10/31	44	540	0.015	4.18E-05	1000	25	20	17.94	
#60	45	540	0.002	4.18E-05	1000	25	20	2.39	Below MDL
#61	46	540	0.009	4.18E-05	250	25	5	43.06	
#62	47	540	0.019	4.18E-05	1000	25	20	22.73	
#63	48	540	0.016	4.18E-05	1000	25	20	19.14	
#63MS	49	540	0.037	4.18E-05	1000	25	20	44.26	
#64	50	540	-0.001	4.18E-05	1000	25	20	-1.20	Below MDL
MB 10/31	53	507	0.001	5.59E-05	1000	25	20	0.89	RDX analysis (Re-extract)
BS 10/31	54	507	0.024	5.59E-05	1000	25	20	21.47	Re-extract
#60	55	507	0.014	5.59E-05	1000	25	20	12.52	Re-extract
#61	56	507	0.354	5.59E-05	250	25	5	1266.55	Re-extract
#62	57	507	0.005	5.59E-05	1000	25	20	4.47	Below MDL (Re-extract)
#63	58	507	-0.003	5.59E-05	1000	25	20	-2.68	Below MDL (Re-extract)
#63MS	59	507	-0.004	5.59E-05	1000	25	20	-3.58	Below MDL (Re-extract)**
#64	60	507	0.014	5.59E-05	1000	25	20	12.52	Re-extract

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

**- Zinc was in contact with extract during entire color development stage (25 MIN)

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 10/30/93

UV D-96

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#76	40	540	-0.003	4.98E-05	1000	25	20	-3.01	below MDL
#77	41	540	-0.001	4.98E-05	250	25	5	-4.02	below MDL

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis

Sample Calculation Worksheet

UMDA

Date : 11/1/93

UV D-97

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#65	3	540	0.005	4.58E-05	250	25	5	21.83	TNT analysis
#66	4	540	0.054	4.58E-05	1000	25	20	58.95	
#67	6	540	0.001	4.58E-05	1000	25	20	1.09	below MDL
#68	7	540	0.004	4.58E-05	250	25	5	17.47	
#69	8	540	0.004	4.58E-05	1000	25	20	4.37	below MDL
#70	9	540	0	4.58E-05	1000	25	20	0.00	below MDL
#71	10	540	0.002	4.58E-05	250	25	5	8.73	
#72	11	540	0.01	4.58E-05	1000	25	20	10.92	
#65	14	507	0.267	1.68E-05	250	25	5	3178.57	RDX analysis
#66	15	507	-0.003	1.68E-05	1000	25	20	-8.93	below MDL
#67	16	507	-0.001	1.68E-05	1000	25	20	-2.98	below MDL
#68 1:5	17	507	0.197	1.68E-05	250	25	1	11726.19	sample diluted 1:5
#69	18	507	-0.003	1.68E-05	1000	25	20	-8.93	below MDL
#70	19	507	-0.005	1.68E-05	1000	25	20	-14.88	below MDL
#71 1:5	20	507	0.254	1.68E-05	250	25	1	15119.05	sample diluted 1:5
#72	21	507	0	1.68E-05	1000	25	20	0.00	below MDL
#60	24	507	0.003	1.49E-05	1000	25	20	10.07	✓
#61 1:5	25	507	0.323	1.49E-05	250	25	1	21677.85	✓
#64	27	507	0.003	1.49E-05	1000	25	20	10.07	✓
#73	28	507	0.008	1.49E-05	1000	25	20	26.85	
#74	29	507	0.336	1.49E-05	250	25	5	4510.07	
#75	30	507	-0.001	1.49E-05	1000	25	20	-3.36	below MDL
#76	31	507	0.001	1.49E-05	1000	25	20	3.36	below MDL
#77	32	507	0.351	1.49E-05	250	25	5	4711.41	
#73	37	540	0.004	4.98E-05	1000	25	20	4.02	TNT analysis - below MDL
#74	38	540	0.001	4.98E-05	250	25	5	4.02	below MDL
#75	39	540	0.075	4.98E-05	1000	25	20	75.30	

* - taken from daily calibration standard

CF = Vi/Vf   Cs = As/RF/CF

TNT and RDX Field Screening Analysis

DAMES & MOORE

Sample Calculation Worksheet

UMDA

Date : 11/2/93

UV D-98

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#78	3	540	0.006	4.18E-05	1000	25	20	7.18	TNT analysis
#79	4	540	0	4.18E-05	1000	25	20	0.00	below MDL
#80	5	540	0.003	4.18E-05	250	25	5	14.35	
#81	6	540	0.011	4.18E-05	1000	25	20	13.16	
#82	7	540	-0.001	4.18E-05	1000	25	20	-1.20	below MDL
#83	8	540	0.006	4.18E-05	250	25	5	28.71	
#84	9	540	0.003	4.18E-05	250	25	5	14.35	
#84MS	10	540	0.007	4.18E-05	250	25	5	33.49	
#78	13	507	-0.002	3.04E-05	1000	25	20	-3.29	RDX analysis-below MDL
#79	14	507	0.01	3.04E-05	1000	25	20	16.45	
#80 (1:5)	15	507	0.173	3.04E-05	250	25	1	5690.79	sample diluted 1:5
#81	16	507	-0.003	3.04E-05	1000	25	20	-4.93	below MDL
#82	17	507	-0.001	3.04E-05	1000	25	20	-1.64	below MDL
#83 (1:5)	18	507	0.222	3.04E-05	250	25	1	7302.63	sample diluted 1:5
#84 (1:5)	19	507	0.07	3.04E-05	250	25	1	2302.63	sample diluted 1:5
#84 MS (1:5)	20	507	0.284	3.04E-05	250	25	1	9342.11	
MB 11/2	23	507	-0.002	3.04E-05	1000	25	20	-3.29	RDX analysis-below MDL
BS 11/2	24	507	0.013	3.04E-05	1000	25	20	21.38	
#62	25	507	0	3.04E-05	1000	25	20	0.00	below MDL
#63	26	507	-0.001	3.04E-05	1000	25	20	-1.64	below MDL
#63MS	27	507	0.005	3.04E-05	1000	25	20	8.22	
#85	28	507	0.054	3.04E-05	1000	25	20	88.82	
#86	29	507	0.011	3.04E-05	1000	25	20	18.09	
#87 (1:5)	30	507	0.119	3.04E-05	250	25	1	3914.47	
MB 11/2	33	540	0	3.59E-05	1000	25	20	0.00	TNT analysis - below MDL
BS 11/2	34	540	0.021	3.59E-05	1000	25	20	29.25	
#85	35	540	0.072	3.59E-05	1000	25	20	100.28	
#86	36	540	-0.001	3.59E-05	1000	25	20	-1.39	below MDL

* - taken from daily calibration standard CF = Vi/Vf Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 11/2/93

UV D-99

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#87	37	540	0.006	3.59E-05	250	25	1	167.13	

* - taken from daily calibration standard CF = Vi/Vf Cs = As/RF/CF

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 11/3/93

UV D-100

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#88	5	540	0.002	4.38E-05	1000	25	20	2.28	TNT analysis - below MDL
#89	4	540	0.001	4.38E-05	1000	25	20	1.14	below MDL
#90	6	540	0.014	4.38E-05	250	25	5	63.93	
#91	7	540	0.017	4.38E-05	1000	25	20	19.41	
#92	8	540	-0.001	4.38E-05	1000	25	20	-1.14	below MDL
#93	9	540	0.003	4.38E-05	250	25	5	13.70	
#94	10	540	0.002	4.38E-05	1000	25	20	2.28	below MDL
#95	11	540	-0.001	4.38E-05	1000	25	20	-1.14	below MDL
#88	15	507	0.058	2.98E-05	1000	25	20	97.32	RDX analysis
#89	16	507	0.005	2.98E-05	1000	25	20	8.39	
#90 1:5	17	507	0.267	2.98E-05	250	25	1	8959.73	
#91	18	507	0.177	2.98E-05	1000	25	20	296.98	
#92	19	507	0.009	2.98E-05	1000	25	20	15.10	
#93 1:5	20	507	0.232	2.98E-05	250	25	1	7785.23	
#94	21	507	0.784	2.98E-05	1000	25	20	1315.44	
#95	22	507	0.008	2.98E-05	1000	25	20	13.42	
MB 11/3	26	507	0	2.98E-05	1000	25	20	0.00	below MDL
BS 11/3	27	507	0.021	2.98E-05	1000	25	20	35.23	
#96 1:5	28	507	0.114	2.98E-05	250	25	1	3825.50	
#97	29	507	0.003	2.98E-05	1000	25	20	5.03	
#98	30	507	0.008	2.98E-05	1000	25	20	13.42	
#99	31	507	0.007	2.98E-05	1000	25	20	11.74	
#99 MS	32	507	0.015	2.98E-05	1000	25	20	25.17	
MB 11/3	36	540	0	4.18E-05	1000	25	20	0.00	TNT analysis - below MDL
BS 11/3	37	540	0.015	4.18E-05	1000	25	20	17.94	
#96	38	540	0.002	4.18E-05	250	25	5	9.57	
#97	39	540	0.001	4.18E-05	1000	25	20	1.20	below MDL

* - taken from daily calibration standard

$CF = Vi/Vf$ $Cs = As/RF/CF$

DAMES & MOORE

TNT and RDX Field Screening Analysis
Sample Calculation Worksheet
UMDA

Date : 11/3/93

UV D-101

Sample ID	Anal. No.	Wave-lenth	Sample Abs (As)	Response Factor* (RF)	Initial Sample Vol (ml) (Vi)	Final Extract Vol (ml) (Vf)	Conc Factor (CF)	Sample Conc (ug/L) (Cs)	Comments
#98	40	540	-0.001	4.18E-05	1000	25	20	-1.20	below MDL
#99	41	540	-0.001	4.18E-05	1000	25	20	-1.20	below MDL
#99 MS	42	540	0.01	4.18E-05	1000	25	20	11.96	

* - taken from daily calibration standard

$CF = Vi/Vf$ $Cs = As/RF/CF$

D.8 DAILY QC CALCULATION WORKSHEETS

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/12/93

Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R	Blank Spike Dup. Conc. (ug/L)	Blank Spike Dup Rec. %R	Relative Percent Difference RPD
BS 10/12	0	24.7	18.52	75			

UV D-103

Sample ID	Sample Concentration (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery %R	Matrix Spike Dup. Conc. (ug/L)	Matrix Spike Dup Rec. %R	Relative Percent Difference RPD
4 - 1	3926	494	4173	50	4148	45	1

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100 RPD = (|(MS - MSD)|/((MS + MSD)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/13/93

UV
D-104

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/13	0	24.7	18.2	74
RDX	BS 10/13	0	24.8	39.3	158

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA
Date: 10/14/93

UV
D-105

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/14	0	24.7	10.2	41
RDX	BS 10/14	0	24.8	46.4	187

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	119	3065	3247	6	494	3584	105
RDX	119	2475	1881	27	496	1436	NR

Comments: Sample #120 is the duplicate of sample #119
NR - not recovered

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|Cs - Cd|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/15/93

UV
D-106

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/15	0	24.7	18.8	76
RDX	BS 10/15	0	24.8	14.2	57

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)

Comments: No matrix sample analyzed on 10/15/93

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/16/93

UV
D-107

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/16	0	24.7	26.3	106
RDX	BS 10/16	0	24.8	26.3	106

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	140	0	0	NC	24.7	14.1	57
RDX	140	35.4	11.3	103	24.8	597.7	2267

Comments: Sample #141 is the duplicate of sample #140
NC - not calculable; must have 2 positive results in order to calculate RPD

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/17/93

UV
D-108

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/17	0	24.7	19.8	80
RDX	BS 10/17	0	24.8	20.4	82

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	161	68.3	93.8	31	24.7	121	213
RDX	161	16	0	NC	24.8	5.8	NR

Comments: Sample #162 is the duplicate of sample #161
NC - not calculable; 2 positive results are required for calculation
NR - not recovered

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/18/93

UV
D-109

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/18	-12.41	24.7	17.73	72
RDX	BS 10/18	5.81	24.8	52.33	211

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	183	3168.6	5174.42	48	24.7	121	NR ~~12338~~
RDX	183	2827.99	4314.87	42	24.8	5.8	NR ~~11380~~

Comments: Sample #183 is the duplicate of sample #182
NC - not calculable; 2 positive results are required for calculation
NR - not recovered

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

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DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/19/93

UV
D-110

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/19	5.32	24.7	21.28	86
	BSD 10/19	5.32	24.7	37.23	151
RDX	BS 10/19	0	24.8	14.53	59
	BSD 10/19	0	24.8	30.52	123

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT							
RDX							

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/28/93

UV
D-111

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/28	0	24.7	21.7	88
RDX	BS 10/28	0	24.8	24.4	98

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	197	0	0	NC	24.7	14.2	57
RDX	197	9.89	4.2	81	24.8	29.7	80

Comments: Sample #198 is the duplicate of sample #197
NC - not calculable; 2 positive results are required for calculation

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/29/93

UV
D-112

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/29	0	24.7	19.1	77
RDX	BS 10/29	0	24.8	81.6	329

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	20	26.5	21.2	22	24.7	47.6	85
RDX	21	1720	1990	15	24.8	2200	1935

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100   RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

Comments: Sample #21 is the duplicate of sample #20

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/30/93

UV
D-113

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/30	0	24.7	20.1	81
RDX	BS 10/30	0	24.8	44.2	178

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	41	0	0	NC	24.7	18.1	73
RDX	41	11.0	6.31	54	24.8	56.8	185

Comments: Sample #42 is the duplicate of sample #41
NC - not calculable; 2 positive results are required for calculation

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 10/31/93

UV
D-114

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 10/31	2.39	24.7	17.94	73
RDX	BS 10/31	0.89	24.8	21.47	87

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	62	22.73	19.14	17	24.7	44.26	87
RDX*	62	4.5	-2.68	799	24.8	-3.58	32

Comments: Sample #63 is the duplicate of sample #62
NC - not calculable; 2 positive results are required for calculation
* Re extract due to Zinc being in contact with sample #63MS extract during entire color development time (25 min)

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: ~~10/31/93~~ 11/2/93

UV
D-115

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 11/2	0	24.7	29.25	118
RDX	BS 11/2	-3.29	24.8	21.38	86

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	83	28.71	14.35	67	24.7	33.49	19
RDX	62	0.0	-1.64	NC	24.8	8.22	33
	83	7302.63	2302.63	104	24.8	9342.11	8224

Comments: Sample #63 is the duplicate of sample #62
NC - not calculable; 2 positive results are required for calculation

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

DAMES & MOORE

TNT and RDX Field Screening Analysis
Daily QC Calculation Worksheet
UMDA

Date: 11/3/93

UV
D-116

Compound	Blank ID	Blank Concentration (ug/L)	Spike Amount (ug/L)	Blank Spike Concentration (ug/L)	Blank Spike Recovery %R
TNT	BS 11/3	0	24.7	17.9	72
RDX	BS 11/3	0	24.8	35.2	142

Compound	Sample ID	Sample Concentration (Cs) (ug/L)	Duplicate Concentration (Cd) (ug/L)	Relative Percent Difference (ug/L)	Spike Amount (ug/L)	Matrix Spike Concentration (ug/L)	Matrix Spike Recovery (%R)
TNT	98	0	0	NC	24.7	12.0	49
RDX	98	13.4	11.7	14	24.8	25.2	48

Comments: Sample #98 is the duplicate of sample #99
NC - not calculable; 2 positive results are required for calculation

%R = ((Spike Conc. - Sample Conc.)/Spike Amount) x 100

RPD = (|(Cs - Cd)|/((Cs + Cd)/2)) X 100

D.9 FIELD SAMPLE CHAIN-OF-CUSTODY FORMS

Environmental Science & Engineering, Inc. 10-30-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE	STA	HAZ?	FRACTIONS (CIRCLE)		DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID
*1	4-13			F	F	10/27/93	11:30	UMW04	GW	WELL			G13I00F
*2	4-13			F	F	10/27/93	14:45	UMW04	GW	WELL			G13I01F
*3	4-13			F	F	10/27/93	14:45	UMW04	GW	WELL			G13U01F
*4	4-13			F	F	10/27/93	14:45	UMW04	GW	WELL			G13E01F
*5	4-13			F	F	10/27/93	18:05	UMW04	GW	WELL			G13I02F
*6	4-13			F	F	10/27/93	18:05	UMW04	GW	WELL			G13U02F
*7	4-13			F	F	10/27/93	18:05	UMW04	GW	WELL			G13E02F
*8	4-13			F	F	10/27/93	21:15	UMW04	GW	WELL			G13I03F
*9	4-13			F	F	10/27/93	21:15	UMW04	GW	WELL			G13U03F
*10	4-13			F	F	10/27/93	21:15	UMW04	GW	WELL			G13E03F
*11	4-13			F	F	10/28/93	0030	UMW04	GW	WELL			G13I04F
*12	4-13			F	F	10/28/93	0030	UMW04	GW	WELL			G13U04F
*13	4-13			F	F	10/28/93	0030	UMW04	GW	WELL			G13E04F
*14	4-13			F	F	10/28/93	0400 ~~0040~~	UMW04	GW	WELL			G13I05F
*15	4-13			F	F	10/28/93	0400 ~~00~~	UMW04	GW	WELL			G13U05F
*16	4-13			F	F	10/28/93	0400	UMW04	GW	WELL			G13E05F
*17	4-13			F	F	10/28/93	0715	UMW04	GW	WELL			G13I06F
*18	4-13			F	F	10/28/93	0715	UMW04	GW	WELL			G13U06F

UV
D-118

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)		DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID #
*19	4-13		F	F	10/28/93	0715	UMW04	GW	WELL			G13E06F
*20	4-13		F	F	10/28/93	10:30	UMW04	GW	WELL			G13I07F
*21	4-13		F	F	10/28/93	10:30	UMW04	GW	WELL			G13I07FD
*22	4-13		F	F	10/28/93	10:30	UMW04	GW	WELL			G13U07F
*23	4-13		F	F	10/28/93	10:30	UMW04	GW	WELL			G13E07F
*24	4-13		F	F	10/28/93	13:45	UMW04	GW	WELL			G13I08F
*25	4-13		F	F	10/28/93	13:45	UMW04	GW	WELL			G13U08F
*26	4-13		F	F	10/28/93	13:45	UMW04	GW	WELL			G13E08F
*27	4-13		F	F	10/28/93	16:55	UMW04	GW	WELL			G13I09F
*28	4-13		F	F	10/28/93	16:55	UMW04	GW	WELL			G13U09F
*29	4-13		F	F	10/28/93	16:55	UMW04	GW	WELL			G13E09F
*30	4-13		F	F	10/28/93	22:15	UMW04	GW	WELL			G13I10F
*31	4-13		F	F	10/28/93 ~~10/28/93~~	22:15 ~~22:15~~	UMW04	GW	WELL			G13U10F
*32	4-13		F	F	10/28/93	22:15	UMW04	GW	WELL			G13E10F
*33	4-13		F	F	10/29/93	01:45	UMW04	GW	WELL			G13I11F
*34	4-13		F	F	10/29/93	01:45	UMW04	GW	WELL			G13U11F
*35	4-13		F	F	10/29/93	01:45	UMW04	GW	WELL			G13E11F
*36	4-13		F	F	10/29/93	05:10	UMW04	GW	WELL			G13I12F

UV
D-119

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on ___/___
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID #
*37	4-13		F F	10/29/93	05:10	UMW04	GW	WELL			G13U12F
*38	4-13		F F	10/29/93	05:10	UMW04	GW	WELL			G13E12F
*39	4-13		F F	10/29/93	08:30	UMW04	GW	WELL			G13I13F
*40	4-13		F F	10/29/93	08:30	UMW04	GW	WELL			G13U13F
*41	4-13		F F	10/29/93	08:30	UMW04	GW	WELL			G13E13F
*42	4-13		F F	10/29/93	~~08:30~~ 08:30	UMW04	GW	WELL			G13E13FD
*43	4-13		F F	10/29/93	12:00	UMW04	GW	WELL			G13I14F
*44	4-13		F F	10/29/93	12:00	UMW04	GW	WELL			G13U14F
*45	4-13		F F	10/29/93	12:00	UMW04	GW	WELL			G13E14F
*46	4-13		F F	10/29/93	1520	UMW04	GW	WELL			G13I15F
*47	4-13		F F	10/29/93	1520	UMW04	GW	WELL			G13U15F
*48	4-13		F F	10/29/93	1520	UMW04	GW	WELL			G13E15F
*49	4-13		F F	10/29/93	1840	UMW04	GW	WELL			G13I16F
*50	4-13		F F	10/29/93	1840	UMW04	GW	WELL			G13U16F
*51	4-13		F F	10/29/93	1840	UMW04	GW	WELL			G13E16F
*52	4-13		F F	10/29/93	2200	UMW04	GW	WELL			G13I17F
*53	4-13		F F	10/29/93	2200	UMW04	GW	WELL			G13U17F
*54	4-13		F F	10/29/93	2200	UMW04	GW	WELL			G13E17F

UV
D-120

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ____ Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	TECH	FIELD ID #
*55	4-13		F F	10/30/93	0110	UMW04	GW	WELL			G13I18F
*56	4-13		F F	10/30/93	0110	UMW04	GW	WELL			G13U18F
*57	4-13		F F	10/30/93	0110	UMW04	GW	WELL			G13E18F
*58	4-13		F F	10/30/93	1100	UMW04	GW	WELL			G13I19F
*59	4-13		F F	10/30/93	1100	UMW04	GW	WELL			G13U19F
*60	4-13		F F	10/30/93	1100	UMW04	GW	WELL			G13E19F
*61	4-13		F F	10/30/93	1420	UMW04	GW	WELL			G13I20F
*62	4-13		F F	10/30/93	1420	UMW04	GW	WELL			G13U20F
*63	4-13		F F	10/30/93	1420	UMW04	GW	WELL			G13U20FD +
*64	4-13		F F	10/30/93	1420	UMW04	GW	WELL			G13E20F
*65	4-13		F F	10/30/93	1735	UMW04	GW	WELL			G13I21F
*66	4-13		F F	10/30/93	17:35	UMW04	GW	WELL			G13U21F
*67	4-13		F F	10/30/93	17:35	UMW04	GW	WELL			G13E21F
*68	4-13		F F	10/30/93	2045	UMW04	GW	WELL			G13I22F
*69	4-13		F F	10/30/93	2045	UMW04	GW	WELL			G13U22F
*70	4-13		F F	10/30/93	2045	UMW04	GW	WELL			G13E22F
*71	4-13		F F	10/31/93	0005	UMW04	GW	WELL			G13I23F
*72	4-13		F F	10/31/93	0005	UMW04	GW	WELL			G13U23F

UV
D-121

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: **I**=IGNITABLE **C**=CORROSIVE **R**=REACTIVE **T**=TOXIC WASTE **H**=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

.5C

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID
*73	4-13		F F	10/31/93	0005	UMW04	GW	WELL			G13E23F
*74	4-13		F F	10/31/93	0240	UMW04	GW	WELL			G13I24F
*75	4-13		F F	10/31/93	0240	UMW04	GW	WELL			G13U24F
*76	4-13		F F	10/31/93	0240	UMW04	GW	WELL			G13E24F
*77	4-13		F F	10/31/93	0600	UMW04	GW	WELL			G13I25F
*78	4-13		F F	10/31/93	0600	UMW04	GW	WELL			G13U25F
*79	4-13		F F	10/31/93	0600	UMW04	GW	WELL			G13E25F
*80	4-13		F F	11/1/93	1400	UMW04	GW	WELL			G13I26F
*81	4-13		F F	11/1/93	1400	UMW04	GW	WELL			G13U26F
*82	4-13		F F	11/1/93	1400	UMW04	GW	WELL			G13E26F
*83	4-13		F F	11/1/93	17:15	UMW04	GW	WELL			G13I27F
*84	4-13		F F	11/1/93	17:15	UMW04	GW	WELL			G13I27FD
*85	4-13		F F	11/1/93 ~~11/1/93~~	17:15 ~~17:15~~	UMW04	GW	WELL			G13U27F
*86	4-13		F F	11/1/93	17:15	UMW04	GW	WELL			G13E27F
*87	4-13		F F	11/1/93	20:55	UMW04	GW	WELL			G13I28F
*88	4-13		F F	11/1/93	20:55	UMW04	GW	WELL			G13U28F
*89	4-13		F F	11/1/93	20:55	UMW04	GW	WELL			G13E28F
*90	4-13		F F	11/2/93	0020	UMW04	GW	WELL			G13I29F

UV
D-122

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1

2

3

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ____ Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: UMPUF
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	[illegible]	FIELD ID
*91	4-13		F F	11/2/93	00:20	UMW04	GW	WELL			G13U29F
*92	4-13		F F	11/2/93	00:20	UMW04	GW	WELL			G13E29F
*93	4-13		F F	11/2/93	03:50	UMW04	GW	WELL			G13I30F
*94	4-13		F F	11/2/93	03:50	UMW04	GW	WELL			G13U30F
*95	4-13		F F	11/2/93	03:50	UMW04	GW	WELL			G13E30F
*96	4-13		F F			UMW04	GW	WELL			G13I31F
*97	4-13		F F			UMW04	GW	WELL			G13U31F
*98	4-13		F F			UMW04	GW	WELL			G13E31F
*99	4-13		F F			UMW04	GW	WELL			G13E31FD
*100	4-1		F F	* 10/13/93	10:30	UMW04	GW	WELL			G01I00F
*101	4-1		F F	10/13/93	14:45	UMW04	GW	WELL			G01I01F
*102	4-1		F F	10/13/93	14:45	UMW04	GW	WELL			G01U01F
*103	4-1		F F	10/13/93	14:45	UMW04	GW	WELL			G01E01F
*104	4-1		F F	10/13/93	18:15	UMW04	GW	WELL			G01I02F
*105	4-1		F F	10/13/93	18:15	UMW04	GW	WELL			G01U02F
*106	4-1		F F	10/13/93	18:15	UMW04	GW	WELL			G01E02F
*107	4-1		F F	10/13/93	21:35	UMW04	GW	WELL			G01I03F
*108	4-1		F F	10/13/93	21:35	UMW04	GW	WELL			G01U03F

UV
D-123

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___ Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	TEMP	FIELD ID #
*109	4-1		F F	10/13/93	21:35	UMW04	GW	WELL			G01E03F
*110	4-1		F F	10/14/93	01:00	UMW04	GW	WELL			G01I04F
*111	4-1		F F	10/14/93	01:00	UMW04	GW	WELL			G01U04F
*112	4-1		F F	10/14/93	01:00	UMW04	GW	WELL			G01E04F
*113	4-1		F F	10/14/93	04:35	UMW04	GW	WELL			G01I05F
*114	4-1		F F	10/14/93	04:35	UMW04	GW	WELL			G01U05F
*115	4-1		F F	10/14/93	04:35	UMW04	GW	WELL			G01E05F
*116	4-1		F F	10/14/93	0755	UMW04	GW	WELL			G01I06F
*117	4-1		F F	10/14/93	0755	UMW04	GW	WELL			G01U06F
*118	4-1		F F	10/14/93	0755	UMW04	GW	WELL			G01E06F
*119	4-1		F F	10/14/93	1155	UMW04	GW	WELL			G01I07F
*120	4-1		F F	10/14/93	1155	UMW04	GW	WELL			G01I07FD
*121	4-1		F F	10/14/93	1155	UMW04	GW	WELL			G01U07F
*122	4-1		F F	10/14/93	1155	UMW04	GW	WELL			G01E07F
*123	4-1		F F	10/15/93	0430	UMW04	GW	WELL			G01I08F
*124	4-1		F F	10/15/93	0430	UMW04	GW	WELL			G01U08F
*125	4-1		F F	10/15/93	0430	UMW04	GW	WELL			G01E08F
*126	4-1		F F	10/15/93	0800	UMW04	GW	WELL			G01I09F

UV
D-124

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ____ Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID
*127	4-1		F F	10/15/93	0800	UMW04	GW	WELL			G01U09F
*128	4-1		F F	10/15/93	0800	UMW04	GW	WELL			G01E09F
*129	4-1		F F	10/15/93	1400	UMW04	GW	WELL			G01I10F
*130	4-1		F F	10/15/93	1400	UMW04	GW	WELL			G01U10F
*131	4-1		F F	10/15/93	1400	UMW04	GW	WELL			G01E10F
*132	4-1		F F	10/15/93	17:30	UMW04	GW	WELL			G01I11F
*133	4-1		F F	10/15/93	17:30	UMW04	GW	WELL			G01U11F
*134	4-1		F F	10/15/93	17:30	UMW04	GW	WELL			G01E11F
*135	4-1		F F	10/15/93	20:45	UMW04	GW	WELL			G01I12F
*136	4-1		F F	10/15/93	20:45	UMW04	GW	WELL			G01U12F
*137	4-1		F F	10/15/93	20:45	UMW04	GW	WELL			G01E12F
*138	4-1		F F	10/16/93	00:00	UMW04	GW	WELL			G01I13F
*139	4-1		F F	10/16/93	00:00	UMW04	GW	WELL			G01U13F
*140	4-1		F F	10/16/93	00:00 ~~24:00~~	UMW04	GW	WELL			G01E13F
*141	4-1		F F	10/16/93	00:00 ~~2400~~	UMW04	GW	WELL			G01E13FD
*142	4-1		F F	10/16/93	~~2400~~ 0405	UMW04	GW	WELL			G01I14F
*143	4-1		F F	10/16/93	0405	UMW04	GW	WELL			G01U14F
*144	4-1		F F	10/16/93.	0405	UMW04	GW	WELL			G01E14F

UV
D-125

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: UMPUF
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID
*145	4-1		F F	10/16	0635	UMW04	GW	WELL			G01I15F
*146	4-1		F F	10/16	0635	UMW04	GW	WELL			G01U15F
*147	4-1		F F	10/16.	·635	UMW04	GW	WELL			G01E15F
*148	4-1		F F	10/16	1005	UMW04	GW	WELL			G01I16F
*149	4-1		F F	10/16	1005	UMW04	GW	WELL			G01U16F
*150	4-1		F F	10/16	1005	UMW04	GW	WELL			G01E16F
*151	4-1		F F	10/16	13:20	UMW04	GW	WELL			G01I17F
*152	4-1		F F	10/16	13:20	UMW04	GW	WELL			G01U17F
*153	4-1		F F	10/16	13:20	UMW04	GW	WELL			G01E17F
*154	4-1		F F	10/16	15:50	UMW04	GW	WELL			G01I18F
*155	4-1		F F	10/16	15:50	UMW04	GW	WELL			G01U18F
*156	4-1		F F	10/16	15:50	UMW04	GW	WELL			G01E18F
*157	4-1		F F	10/16	20:30	UMW04	GW	WELL			G01I19F
*158	4-1		F F	10/16	20:30	UMW04	GW	WELL			G01U19F
*159	4-1		F F	10/16	20:30	UMW04	GW	WELL			G01E19F
*160	4-1		F F	~~10/16~~ 10/17	~~24:00~~ 00:00	UMW04	GW	WELL			G01I20F
*161	4-1		F F Dmw 10/18/93	~~10/16~~ 10/17	~~24:00~~ 00:00	UMW04	GW	WELL			G01U20F
*162	4-1		F F	~~10/16~~ ~~10/16~~ 10/17	~~24:00~~ 00:00	UMW04	GW	WELL			G01U20FD*

UV
D-126

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1

2

3

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on ___/___
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ____ Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)		DATE	TIME	PARAMETER LIST	SAMP TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID
*163	4-1		F	F	10/16	24:00	UMW04	GW	WELL			G01E20F
*164	4-1		F	F	10/16	24:00	UMW04	GW	WELL			G01I21F
*165	4-1		F	F	10/17	03:50	UMW04	GW	WELL			G01U21F
*166	4-1		F	F	10/17	03:50	UMW04	GW	WELL			G01E21F
*167	4-1		F	F	10/17	07:30	UMW04	GW	WELL			G01I22F
*168	4-1		F	F	10/17	07:30	UMW04	GW	WELL			G01U22F
*169	4-1		F	F	10/17	07:30	UMW04	GW	WELL			G01E22F
*170	4-1		F	F	10/17	11:05	UMW04	GW	WELL			G01I23F
*171	4-1		F	F	10/17	11:05	UMW04	GW	WELL			G01U23F
*172	4-1		F	F	10/17	11:05	UMW04	GW	WELL			G01E23F
*173	4-1		F	F	10/17	14:35	UMW04	GW	WELL			G01I24F
*174	4-1		F	F	10/17	14:35	UMW04	GW	WELL			G01U24F
*175	4-1		F	F	10/17	14:35	UMW04	GW	WELL			G01E24F
*176	4-1		F	F	10/17	18:05	UMW04	GW	WELL			G01I25F
*177	4-1		F	F	10/17	18:05	UMW04	GW	WELL			G01U25F
*178	4-1		F	F	10/17	18:05	UMW04	GW	WELL			G01E25F
*179	4-1		F	F	10/17	21:25	UMW04	GW	WELL			G01I26F
*180	4-1		F	F	10/17	21:25	UMW04	GW	WELL			G01U26F

UV
D-127

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID
*181	4-1		F F	10/17/93	21:25	UMW04	GW	WELL			G01E26F
*182	4-1		F F	10/18/93	00:55	UMW04	GW	WELL			G01I27F
*183	4-1		F F	10/18/93	00:55	UMW04	GW	WELL			G01I27FD
*184	4-1		F F	10/18/93	00:55	UMW04	GW	WELL			G01U27F
*185	4-1		F F	10/18/93	00:55	UMW04	GW	WELL			G01E27F
*186	4-1		F F	10/18/93	19:00	UMW04	GW	WELL			G01I28F
*187	4-1		F F	10/18/93	19:00	UMW04	GW	WELL			G01U28F
*188	4-1		F F	10/18/93	19:00	UMW04	GW	WELL			G01E28F
*189	4-1		F F	10/18/93	22:15	UMW04	GW	WELL			G01I29F
*190	4-1		F F	10/18/93	22:15	UMW04	GW	WELL			G01U29F
*191	4-1		F F	10/18/93	22:15	UMW04	GW	WELL			G01E29F
*192	4-1		F F	10/19/93	01:45	UMW04	GW	WELL			G01I30F
*193	4-1		F F	10/19/93	01:45	UMW04	GW	WELL			G01U30F
*194	4-1		F F	10/19/93	01:45	UMW04	GW	WELL			G01E30F
*195	4-1		F F	10/21/93	06:30	UMW04	GW	WELL			G01I31F
*196	4-1		F F			UMW04	GW	WELL			G01U31F
*197	4-1		F F			UMW04	GW	WELL			G01E31F
*198	4-1		F F			UMW04	GW	WELL			G01E31FD

UV
D-128

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
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RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1

2

3

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on __/__
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ____ Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID #
*199			F F			UMW04					
*200			F F			UMW04					
*201			F F			UMW04					
*202			F F			UMW04					
*203			F F			UMW04					
*204			F F			UMW04					
*205			F F			UMW04					
*206			F F			UMW04					
*207			F F			UMW04					
*208			F F			UMW04					
*209			F F			UMW04					
*210			F F			UMW04					
*211			F F			UMW04					
*212			F F			UMW04					
*213			F F			UMW04					
*214			F F			UMW04					
*215			F F			UMW04					
*216			F F			UMW04					

D-129
UV

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
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RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ______ (#) more samples on ___/___
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ____Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

Environmental Science & Engineering, Inc. 10-06-93 *** FIELD LOGSHEET *** FIELD GROUP: **UMPUF**
PROJECT NUMBER 3924062G 0200 PROJECT NAME: UMATILLA PUMP TEST LAB COORD. JOE VONDRICK

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)	DATE	TIME	PARAMETER LIST	SAM TYPE	SITE TYPE	DEPTH FEET	S TECH	FIELD ID #
*217			F F			UMW04					
*218			F F			UMW04					
*219			F F			UMW04					
*220			F F			UMW04					
*221			F F			UMW04					
*222			F F			UMW04					
*223			F F			UMW04					
*224			F F			UMW04					
*225			F F			UMW04					

D-130 UV

-CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1		
2		
3		

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on ___/___
SAMPLE CUSTODIAN: Custody Seals Used? Yes/No; If Yes, Seals Intact? Yes/No Interior Temp? ___Deg C
Preservatives Audited? Yes/No Any Problems? Yes/No; If Yes, describe:

D.10 FIELD LABORATORY NOTES

BLUELINE

RECYCLED PAPER · PAPIER RECYCLÉ ·

#1

Dames & Moore
1750 S. W. Harbor Way
Suite 400
Portland, Oregon 97201

Field Laboratory Notebook #1
Field Sampling for TNT & RDX
UMDA, Hermiston, OR
10/2/93 to 10/19/93

POSTMASTER
RETURN IF NOT DELIVERED
RETURN POSTAGE GUARANTEED
215.15 PDX

BLUELINE

A82
Record
Registre

UV
D-132

10/2/93

FIELD SCREENING LABORATORY NOTEBOOK FOR RDX AND TNT ANALYSIS

CHEMISTS : DAVID WECHSLER (SEA) , DEBBIE LEIBENSBERGER (PET)

TNT STANDARD SOLUTIONS

DATE	STD	STOCK CONC. (ug/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC. ug/L
8/30/93	5000 PPB	988	0.5	100	4940
↓	1000 PPB	4.94	20	↓	988
	100 PPB	0.988	10		98.8
	10 PPB	0.0988	10		9.88
	5 PPB	0.00988	50		4.94

RDX STANDARD SOLUTIONS

DATE	STD	STOCK CONC. (ug/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC. (ug/L)
9/30/93	5000 PPB	992	0.50	100	4960
↓	1000 PPB	4.96	20	↓	992
	100 PPB	0.992	10		99.2
	10 PPB	0.0992	10		9.92
	5 PPB	0.00992	50		4.96

DISCARDING 10 AND 5 PPB STANDARDS FOR BOTH TNT AND RDX. UNABLE TO READ 5 AND 10 PPB ~~TNT~~ STANDARD ON SPECTROPHOTOMETER WILL SUPPLEMENT WITH 50 AND 500 PPB STANDARDS FOR 5 POINT CURVE

DMW 10/2/93

UV

D-133

02

TNT STANDARD SOLUTIONS

DATE	STD	STOCK CONC. (mg/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC. (ug/L)
10/2/93	500 PPB	4.94	10	100	494
	50 PPB	0.494	↓	↓	49.4

ANALYZED 100 PPB STANDARD TNT AFTER AUTOZEROING THE INSTRUMENT WITH REAGENT BLANK. AN ABSORBANCE OF -0.001 WAS READ FOR THE 100 PPB TNT STANDARD. A NEW 100 PPB STANDARD WAS PREPARED ~~FOR~~ FROM THE 1000 PPB STANDARD.

DATE	STD	STOCK CONC. (ug/L)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC. (ug/L)
10/2/93	100 PPB	988	10	100	98.8

COLOR DEVELOPED ALL 5 POINTS OF THE TNT CURVE AND ANALYZED STANDARDS.

ANALYSIS #	CONC. (ug/L)	ABSORBANCE
1	5000	0.156
2	1000	0.023
3	500	0.008
4	100	-0.004
5	50	-0.005

UNABLE TO ACHIEVE 100 PPB INSTRUMENT DETECTION LIMIT (IDL). THE IDL IS NECESSARY FOR OBTAINING THE ACTION LIMIT OF 5 ug/L METHOD DETECTION LIMIT

$100 \, ng/ml \times \frac{10 ml}{1} \times \frac{5 ml}{25 ml} \times \frac{25 ml}{1000 ml} \times \frac{10 ml}{5 ml} = 5 \, ng/ml = 5 \, ug/L$

UV
D-134

WE DECIDED TO MAKE A NEW INTERMEDIATE STANDARD SOLUTION OF 20 µg/ml AND THEN MAKE THE INDIVIDUAL WORKING STANDARDS FROM THE INTERMEDIATE.

TNT STOCK SOLUTION : 988 µg/ml

$988\ \mu g/ml \times \frac{2\ ml}{100\ ml} = 19.76\ \mu g/ml$ INTERMEDIATE STOCK STANDARD.

~~5000 PPB : 19.76 µg/ml × 25 ml / 100 ml =~~

TNT STANDARDS

DATE	STD.	STOCK CONC. (µg/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC. (µg/L)
10/2/93	20 PPM STOCK	988	2	100	19760 ~~X~~
↓	5000 PPB	19.76	25	↓	4940
	1000 PPB	↓	5		988
	500 PPB		2.5		494
	250 PPB		1.25		247
	100 PPB		0.50		98.8

STANDARDS WERE COLOR DEVELOPED ACCORDING TO THE METHOD SOP AND WERE ANALYZED ON THE SPECTROPHOTOMETER.

HOTOMF ... :37

D	ABS	CONC (µg/L)	RF
1	0.000	0	
2	0.273	5000	5.46×10^{-5}
3	0.046	1000	4.6×10^{-5}
4	0.018	500	3.6×10^{-5}
~~5~~	~~0.00?~~		
~~6~~	~~0.00?~~		
7	0.007	250	2.8×10^{-5}
8		100	~~1×10^{-5}~~

UV
D-135

CORRELATION OF STANDARDS = 0.9994

[signature] 10/2/93

10/3/93

CHEMISTS : DEBBIE LEIBENSBERGER (PET), DAVID WECHSLER (SEA)

MADE UP NEW REAGENT BLANK FOR TNT. WE WILL REANALYZE THE COLOR DEVELOPED TNT STANDARDS FROM 10/2 TO DETERMINE THE STABILITY AND LONGEVITY OF A COLOR DEVELOPED STANDARD.

COLOR DEVELOPED STANDARDS SHOWED OBVIOUS SIGNS OF DETERIORATION. COLOR INTENSITY OF STANDARDS VISIBLY MUCH LIGHTER THAN WHEN FRESHLY PREPARED. WILL NOT REANALYZE THESE, INSTEAD WILL COLOR DEVELOP ORIGINAL STANDARDS FROM 10/2 AND ANALYZE TO DETERMINE THE STABILITY OF ~~ST~~ THE STANDARDS.

PHOTOM [illegible] 3:55

ID			RF
STD 1	0.000	0.000	
STD 2	0.005	100.0	5×10^{-5}
STD 3	0.013	250.0	5.2×10^{-5}
STD 4	0.026	500.0	5.2×10^{-5}
STD 5	0.051	1000	5.1×10^{-5}
STD 6	0.281	5000	5.62×10^{-5}

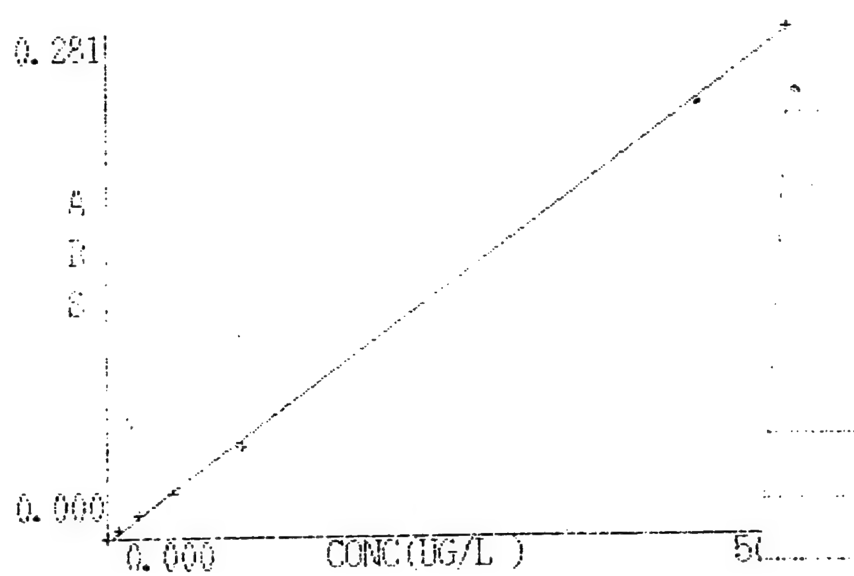
K= **** A0= -0.001 CORR = 0.9998

RSD = 4.5 %

PHOTOMETRY/TNT 10/03/93 09:20

ABS CONC F

PHOTOMETRY/TNT 10/03/93 09:20



UV
D-136

DAW

RDX INTERMEDIATE STOCK SOLUTION:

$$992\ \mu g/ml \times \frac{5\,ml}{250\,ml} = 19.84\ \mu g/ml$$

RDX WORKING STANDARD SOLUTIONS:

5000 PPB: $19.84\ \mu g/ml \times \frac{25\,ml}{100\,ml} = 4960\ \mu g/L$

1000 PPB: $19.84\ \mu g/ml \times \frac{5\,ml}{100\,ml} = 992\ \mu g/L$

500 PPB: $19.84\ \mu g/ml \times \frac{2.5\,ml}{100\,ml} = 496\ \mu g/L$

250 PPB: $19.84\ \mu g/ml \times \frac{1.25\,ml}{100\,ml} = 248\ \mu g/ml$

100 PPB: $19.84\ \mu g/ml \times \frac{0.5\,ml}{100\,ml} = 99.2\ \mu g/ml$

ALL WORKING ~~STANDARD~~ CALIBRATION STANDARDS WERE PREPARED WITH 3 ml OF WATER FOR EVERY 100 ml OF SOLUTION.

DATE	ANALYTE	STD	STOCK CONC. (µg/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONCENTRATION (µg/L)
10/3/93	RDX	20 PPM STOCK	992	5	250	19840
		5000 PPB	19.84	25	100	4960
		1000 PPB		5		992
		500 PPB		2.5		496
		250 PPB		1.25		248
		100 PPB		0.5		99.2

THE INITIAL CALIBRATION FROM 10/3 FOR RDX IS SHOWN ON PG. 6.

TO CLEAN CUVETTES AFTER AN RDX SOLUTION HAS BEEN MEASURED USE DI WATER (2 RINSES) AND THEN ACETONE (2 RINSES).

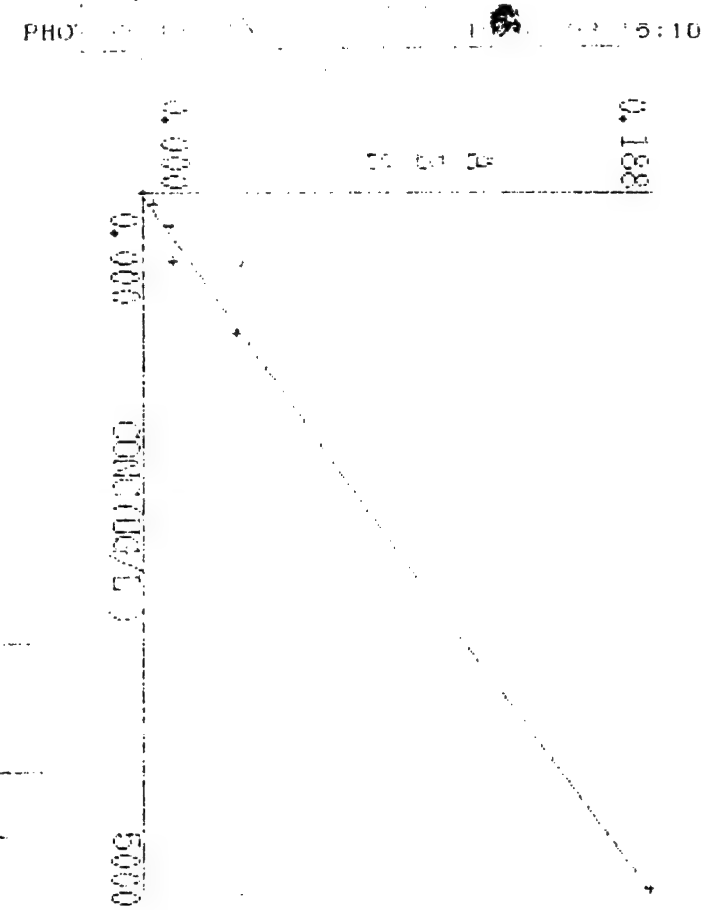
Dan 10/3/93

UV

D-137

06

RDX CALIBRATION



PHOTOMETRY / RDX

ID	ABS	CONC.	RF
1	0.000	0.000	
2	0.005	100.0	5×10^{-5}
3	0.011	250.0	4.4×10^{-5}
4	0.012	500.0	2.4×10^{-5}
5	0.035	1000	3.5×10^{-5}
6	0.188	5000	3.76×10^{-5}

RSD = 25.7

N = 10 MEAN = 0.036 SD = 0.084 CV = 236.1

CORR = 0.9990 WITH 500 PPB STANDARD

CORR = 0.9998 WITHOUT 500 PPB STANDARD

DMW 10/3/9?

UV

D-138

THE 5000 PPB ~~[illegible]~~ TNT STANDARD COLOR DEVELOPED AND ANALYZED ON 10/3/93 AT APPROXIMATELY 09:00 WAS REANALYZED AT 16:41 ON 10/3/93. AN ABSORBANCE REDUCTION OF 43% WAS OBSERVED FROM THE INITIAL ANALYSIS. THE COLOR DEVELOPED STANDARD WAS STORED IN A CLEAR VIAL IN THE SEALED (DARK) COOLER ~~I~~ THROUGHOUT THE DAY.

IOTOME 1 3/93 16:41

	ABS	CONC
1	0.161	2874

ACTUAL 5000 PPB STAND.

DWW 10/3/93

10/4/93

CHEMISTS: DEBBIE LEIBENSBERGER (PET) ; DAVID WECHSLER (SEA)

SPIKING SOLUTION CONCENTRATION:

CONC. AFTER EXTRACTION: 500 µg/L

500 µg/L × 1/20 = 25 µg/L SPIKE CONCENTRATION

↑ CONCENTRATION FACTOR FROM EXTRACTION

SPIKE SOLUTION: 25 µg/ml

25 µg/ml × 1 ml / 1 L = 25 µg/L → TRUE VALUE.

1 ml → VOLUME SPIKED

1 L → VOLUME OF SAMPLE TO BE SPIKED.

PREPARED NEW TNT REAGENT BLANK AND 500 PPB TNT STANDARD. BLANK READ 0.000 ABSORBANCE AGAINST TNT CURVE AND 500 PPB STANDARD READ 535.0 µg/L AGAINST TNT CURVE. 500 PPB STANDARD % D WAS : $\frac{535.0-494}{494} \times 100 = 8.3\%$

SPIKE SOLUTION:

TNT STOCK: 988 µg/ml × 2.5 ml / 100 ml = 24.7 µg/ml

RDX STOCK: 992 µg/ml × 2.5 ml / 100 ml = 24.8 µg/ml

ANALYTE	DATE	STD	STOCK CONC. (µg/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC (µg/ml)
TNT	10/4/93	SPIKE SOLUTION	988	2.5	100	24.7
RDX	↓	↓	992	2.5	↓	24.8

A COLOR DEVELOPED RDX 1000 PPB STANDARD WAS ANALYZED AFTER 15 MINUTES OF COLOR DEVELOPMENT. THE STANDARD READ 889 PPB

AFTER 20 MINUTES OF COLOR DEVELOPMENT THE STANDARD WAS REANALYZED AND THE VALUE WAS READ AT 916 PPB. THIS CONCENTRATION VALUE IS WITHIN THE QC CRITERIA OF ± 10% FOR A CONTINUING CALIBRATION. ALL RDX SAMPLES AND STANDARDS WILL BE COLOR DEVELOPED FOR 20 MINUTES.

A METHOD BLANK AND A METHOD BLANK SPIKE (1 LITER OF EACH) WERE EXTRACTED THROUGH THE SPE CARTRIDGES ACCORDING TO THE METHOD SOP. THE EXTRACTS WERE SPLIT AND COLOR DEVELOPED ACCORDING TO THE METHOD SOP. THE RDX SPIKE RECOVERY WAS HIGH:

SOLUTION CONC = 811.1 ug/L × $\frac{1}{20}$ = 40.56 ug/L

TRUE VALUE = 24.8 ug/L %R = $\frac{40.56}{24.8}$ × 100 = 164%

TNT SPIKE RECOVERY WAS ACCEPTABLE:

SPIKE RECOVERED = 482.4 ug/L × $\frac{1}{20}$ = 24.12 ug/L

TRUE VALUE = 24.7 ug/L

%R = $\frac{24.12}{24.7}$ × 100 = 98%

DWW 10/4/93

FINAL CONC (mg/mL)

24.7

24.8

AFTER

889 PPB.

UV

D-141

10/5/93

CHEMISTS: DAVID WECHSLER (SEA) DEBBIE LEIBENSBERGER (PET)
JOHN KEARNS (BAL)

SETUP VACUUM EXTRACTION MANIFOLD TO EXTRACT 7 SAMPLES. EXTRACTED 1 METHOD BLANK AND 6 BLANK SPIKES WITH 2 ml OF MATRIX SPIKE SOLUTION. SETTING UP THE EXTRACTION UNIT AND CONDITIONING THE SOLID PHASE EXTRACTION (SPE) CARTRIDGES TOOK SLIGHTLY MORE THAN 1 HOUR. SPE CARTRIDGE CONDITIONING CONSISTS OF ELUTING 10 ml OF ACETONE FOLLOWED IMMEDIATELY WITH 2 ~~-~~ 25 ml ALIQUOTS OF DI WATER. APPROXIMATELY ½" OF WATER WAS LEFT ON TOP OF THE CARTRIDGE PACKING TO MAINTAIN WETNESS OF THE PACKING. ~~A~~ 1 LITER OF SAMPLE IS THEN ELUTED DROPWISE AT APPROXIMATELY 5-10 ml/min THROUGH THE CARTRIDGE UNTIL ALL THE SAMPLE IS EXTRACTED. THE SPE CARTRIDGE SHOULD REMAIN WET FROM THE BEGINNING OF THE CONDITIONING UNTIL AFTER THE SAMPLE IS ELUTED THROUGH THE CARTRIDGE. THE CARTRIDGES ARE THEN RINSED TWICE WITH 25 ml OF DI WATER AND TAKEN TO DRYNESS. THE SAMPLE COLLECTION VESSELS WERE PLACED IN THE VACUUM MANIFOLD AND 10 ml OF ACETONE WAS ADDED TO EACH SPE CARTRIDGE. THE ACETONE WAS PULLED TO THE BOTTOM OF THE CARTRIDGE AND ALLOWED TO SIT FOR 5 MINUTES BEFORE THE EXTRACT WAS ELUTED THROUGH THE CARTRIDGE DROPWISE UNTIL DRYNESS. THE EXTRACTS WERE TAKEN TO 10 ml WITH ACETONE.

A TNT CALIBRATION CURVE WAS ANALYZED USING UNFILTERED ACETONE AS THE REFERENCE SOLUTION. LINEARITY WAS OBTAINED r=0.9990 THE REAGENT BLANK USED WAS PREPARED AT 8 AM. THE WORKING

STANDARDS WERE PREPARED ON 10/5/93 AND WERE COLOR DEVELOPED AT APPROXIMATELY 11 AM. THE CALIBRATION CURVE IS SHOWN BELOW.

CALIBRATION BEGAN @ 11:__ AM

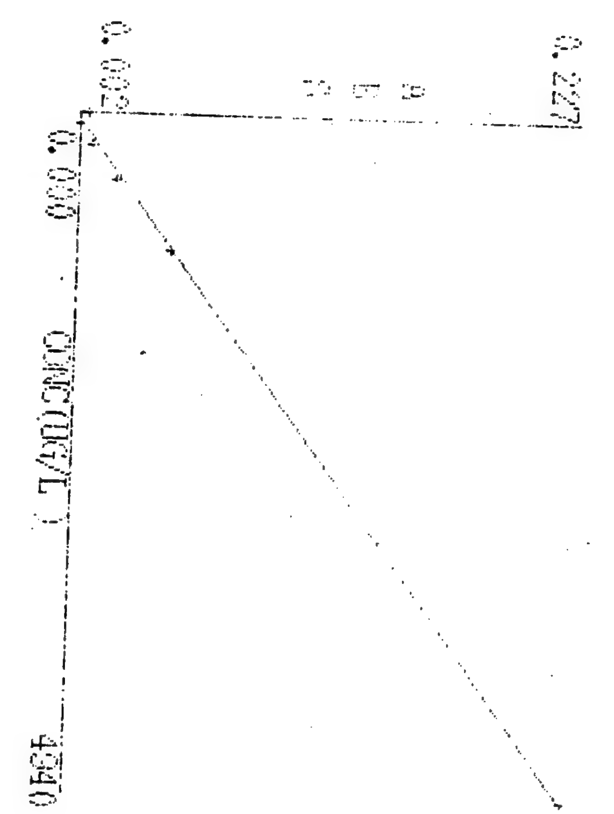
ID	ABS	CONC	
STD 1	0.006	0.000	REAGENT BLANK
STD 2	0.002	98.80	100 PPB
STD 3	0.008	247.0	250 PPB
STD 4	0.019	494.0	
STD 5	0.044	988.0	
STD 6	0.227	4940	

K= **** A0= -0.001

PHOTOMETRY/TNT 10/05/93 11:27

ID	ABS	CONC	F

PHOTOMETRY/TNT 10/05/93 11:27



TRY/TNT 10/05/93 11:28

MEAN= 367.2 SD= 646.0 CV= 175.9

NEW RB

UV

D-143

[redacted]

THE CALIBRATION STANDARDS WERE REANALYZED AND MEASURED AGAINST THE CURVE. THE RESULTS ARE SHOWN BELOW AND THE STANDARDS APPEAR UNSTABLE.

11:42

ID	ABS	CONC	F	TRUE	%D
1	0.017	444.6	~~500~~	494	10.0
2	0.192	4171	~~5000~~	4940	15.6
3	0.193	4197	~~5000~~	↓	15.0
4	0.039	892.0	~~1000~~	988	9.7
5	0.040	896.8	~~1000~~	↓	9.2
6	0.098	252.5	~~250~~	247	2.2
7	0.004	150.1	~~100~~	98.8	51.9
8			~~5000~~	4940	33.0
9			~~100~~	98.8	261
10			~~100~~	98.8	328

2 BLANK SPIKES WERE COLOR DEVELOPED FOR TNT AND ANALYZED AGAINST THE CURVE RUN ON 10/3/97. INITIALLY THE VALUES ~~ROSE~~ INCREASED FOR APPROXIMATELY 10 MINUTES AFTER COLOR DEVELOPMENT AND THE STABILIZED FOR 5 MINUTES AND THEN THE ABSORBANCE VALUES BEGAN TO DECREASE CONTINUALLY.

~~PROJECT~~ PROPOSED CHANGES TO LAB SET-UP AND PROCEDURES:

① MOVE INSTRUMENT OFF THE COUNTER WHERE THE HOOD IS LOCATED IN ORDER TO REMOVE POSSIBLE INSTRUMENT FLUCTUATION CAUSED BY THE HOOD VIBRATIONS.

② ADD 800 ml OF WATER TO THE TNT EXTRACTS (FINAL VOLUME 25) TO SIMULATE THE SAME AMOUNT OF WATER ADDED TO THE STANDARDS DURING PREPARATION.

③ RUN AN EXPERIMENT COLOR DEVELOPING 2 TNT EXTRACTS WITH WATER ADDED AND 2 TNT EXTRACTS WITHOUT WATER ADDED. ANALYZE THE SAMPLES FOR APPROXIMATELY 1/2 HOUR TO TRACK ABSORBANCES.

THE INSTRUMENT WAS MOVED ONTO A STABLE TABLE FREE FROM VIBRATIONS. 2 BLANK SPIKES WERE COLOR DEVELOPED; ONE WITH WATER ADDED AND ONE WITHOUT WATER. THE EXTRACT WITH THE WATER ADDED TO IT COLOR DEVELOPED IMMEDIATELY WHILE THE EXTRACT WITHOUT WATER ADDED COLOR DEVELOPED BY THE END OF THE 3 MINUTE SHAKING PERIOD. THE EXTRACTS WERE ANALYZED FOR 40 MINUTES AND THE RESULTS ARE SHOWN BELOW.

TEST # 1 COLOR DEVELOPMENT BEGAN AT 16:50

WITH WATER				WITHOUT WATER			
TIME	ABS.	TIME	ABS.	TIME	ABS.	TIME	ABS.
16:58	0.056	17:32	0.067	16:57	0.055	17:31	0.060
17:00	0.059	17:34	0.067	16:59	0.057	17:33	0.056
17:02	0.060	17:36	0.067	~~16~~ 17:01	0.054	17:35	0.056
17:04	0.061	17:38	0.068	17:03	0.054	17:37	0.056
17:06	0.063			17:05	0.054		
17:08	0.063			17:07	0.054		
17:10	0.063			17:09	0.054		
17:12	0.064			17:11	0.054		
17:14	0.064			17:13	0.055		
17:16	0.065			17:15	0.056		
17:18	0.066			17:17	0.055		
17:20	0.065			17:19	0.055		
17:22	0.067			17:21	0.055		
17:24	0.066			17:23	0.055		
17:26	0.068			17:25	0.055		
17:28	0.066			17:27	0.056		
17:30	0.068			17:29	0.056		

UV
D-145

[redacted]

THE SAME PROCEDURE WITH THE COLOR DEVELOPMENT WAS PERFORMED ON 2-MORE BLANK SPIKE EXTRACTS AND THE EXTRACTS BEHAVE IN THE SAME MANNER AS THE PREVIOUS 2 EXTRACTS. THE EXTRACTS WERE ANALYZED FOR 30 MINUTES AND THE RESULTS ARE SHOWN BELOW.

TEST # 2 COLOR DEVELOPMENT BEGAN AT 17:44

WITH WATER TIME	ABS.	WITHOUT WATER TIME	ABS
17:51	0.061	17:52	0.057
17:53	0.062	17:54	0.057
17:55	0.061	17:56	0.057
17:57	0.063	17:58	0.058
17:59	0.061	18:00	0.057
18:01	0.061	18:02	0.058
18:03	0.061	18:04	0.059
18:05	0.061	18:06	0.058
18:07	0.060	18:08	0.058
18:09	0.060	18:10	0.058
18:11	0.060	18:12	0.059
18:13	0.059	18:14	0.059
18:15	0.059	18:16	0.058
18:17	0.059	18:18	0.057
18:20	0.059	18:21	0.060
18:22	0.060	18:23	0.058

THE SECOND BLANK SPIKE EXTRACT WITHOUT WATER WAS SCANNED ONCE EVERY 60 SECONDS FOR 2 HOURS TO DETERMINE THE ~~DATE~~ HOLDING TIME

FOR COLOR DEVELOPED TNT EXTRACTS. THE RESULTS ARE SHOWN BELOW

NW

TIME SCAN/TNT 10/05/93 18:30

sec	ABS
0	0.058
60	0.058
120	0.058
180	0.058
240	0.058
300	0.057
360	0.058
420	0.058
480	0.058
540	0.057
600	0.057
660	0.058
720	0.057
780	0.057
840	0.057
900	0.057
960	0.[illegible]
1020	0.[illegible]
1080	0.[illegible]
1140	0.[illegible]
1200	0.057
1260	0.05[illegible]
1320	0.05[illegible]
1380	0.05[illegible]
1440	0.05[illegible]
1500	0.05[illegible]
1560	0.05[illegible]
1620	0.057
1680	0.057
1740	0.057
1800	0.057
1860	0.057
1920	0.057
1980	0.058
2040	0.058
2100	0.058
2160	0.058
2220	0.058
2280	0.058
2340	0.058
2400	0.058
2460	0.058
2520	0.058
2580	0.058
2640	0.058
2700	0.058
2760	0.059
2820	0.059
[illegible]	[illegible]
[illegible]	[illegible]

sec	ABS
3180	0.060
3240	0.060
3300	0.061
3360	0.061
3420	0.061
3480	0.062
3540	0.062
3600	0.062
3660	0.063
3720	0.063
3780	0.063
3840	0.063
3900	0.064
3960	0.064
4020	0.064
4080	0.064
4140	0.064
4200	0.065
4260	0.065
[illegible]	0.065
4380	0.065
4440	0.065
4500	0.065
4560	0.065
4620	0.065
4680	0.065
4740	0.065
4800	0.065
4860	0.065
4920	0.065
4980	0.065
5040	0.065
5100	0.065
5160	0.066
5220	0.066
5280	0.066
5340	0.066
5400	0.066
5460	0.065
5520	0.066
5580	0.066
5640	0.066
5700	0.066
5760	0.066
5820	0.066
5880	0.066
5940	0.066
6000	0.066
6060	0.066
612[illegible]	[illegible]
6180	0.066
[illegible]	[illegible]

sec	ABS
6360	0.066
6420	0.066
6480	0.066
6540	0.066
6600	0.066
6660	0.066
6720	0.065
6780	0.066
6840	0.066
6900	0.066
6960	0.066
7020	0.066
7080	0.066
7140	0.066
7200	0.066

UV

D-147

Dnw 10/5/93

10/6/93

CHEMISTS: DAVID WECHSLER (SEB) DEBBIE LEIBENSBERGER (PET)

COLOR DEVELOPED FOR 20 MINUTES 1000 PPB RDX STANDARD PREPARED ON 10/3/93 TO READ ON SPECTROPHOTOMETER TO TEST STABILITY OF DILUTED STANDARDS. STANDARD READ AT 1623 ug/L ON SPEC. PREPARED NEW STANDARD AT 1000 PPB AND MEASURED ON SPEC. NEW STANDARD MEASURED AT 1401 ug/L. NEW CALIBRATION CURVE STANDARDS WERE PREPARED AND ANALYZED. THE COLOR DEVELOPMENT TIME OF NEW STANDARDS WAS 15 MINUTES. ALL STANDARDS PREPARED EXACTLY AS DESCRIBED ON PAGE 5, EXCEPT FOR 20 PPM WORKING STOCK; 2 ml OF 992 ug/ml RDX STOCK INTO ~~100 ml OF~~ ACETONE WITH FINAL VOLUME AT 100 ml.

5 BLANK SPIKES WITH 2 ml OF SPIKING SOLUTION AND A METHOD BLANK WERE EXTRACTED WITH CONDITIONED SPE CARTRIDGES AND TAKEN TO 10 ml IN ACETONE. THE EXTRACTS WERE SPLIT FOR RDX AND TNT ANALYSIS.

BS #4 FOR RDX WAS ACIDIFIED IN THE SYRINGE WITH ZINC DUST ALREADY IN THE SYRINGE. THIS PROVED TO BE A VERY MESSY PROCEDURE AND DECIDED NOT TO TRY THIS AGAIN. ALL OTHER RDX EXTRACTS WERE ACIDIFIED IN A SEPARATE VIAL BEFORE BEING POURED INTO THE SYRINGE WITH ZINC DUST.

ALL RDX EXTRACTS WERE ~~ACIDIFIED~~ ALLOWED TO COLOR DEVELOP FOR 0.5 HOURS BEFORE FINAL FILTRATION.

TNT 500 PPB STANDARD WAS PREPARED AS DESCRIBED ON PAGE 3.
2.5 ml OF 20 PPM STOCK INTO ACETONE WITH 3 ml OF WATER
FINAL VOLUME WAS 100 ml.

UV

8? 17

RDX CALIBRATION CURVE

ALL OTHER DATA IN LABORATORY DATA NOTEBOOK

PHOTOMETRY/RDX ... 08:15

ID	ABS	CONC	F
1	0.000	0.000	LO
2	0.059	1623	
3	0.051	1401	

PHOTOMETRY/RDX 10/06/93 09:34

ID	ABS	CONC

PHOTOMETRY/RDX 10/06/93 10:19

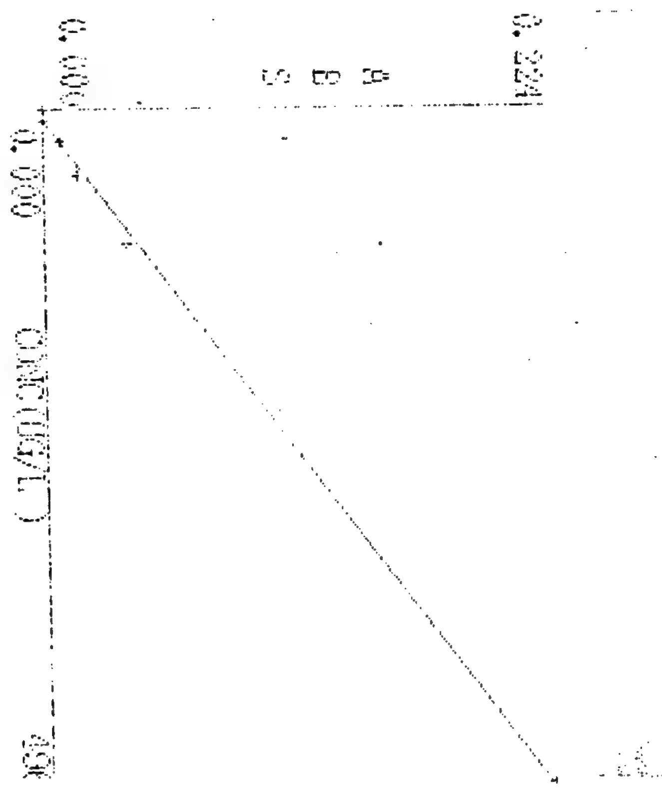
ID	ABS	CONC
#1 STD 1	0.000	0.000
STD 2	0.001	99.20
STD 3	0.008	248.0
STD 4	0.016	496.0
STD 5	0.037	992.0
STD 6	0.224	4960

K= **** A0= -0.004

PHOTOMETRY/RDX 10/06/93 11:09

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/06/93 11:12



DMW 10/6/93

UV

D-149

10/11/93

CHEMISTS: JOHNNA MOORE (SEA) DAVID WECHSLER (SEA)

COLLECTED 3 LITERS OF SAMPLE WATER FROM TREATMENT SYSTEM FOR TESTING OF METHOD. SETUP 1 METHOD BLANK, 2 BLANK SPIKES, 1 SAMPLE, AND 2 SAMPLE MATRIX SPIKES FOR EXTRACTION AND ANALYSIS FOR TNT AND RDX. ALL SPIKED SAMPLES WERE FORTIFIED WITH 2ml OF SPIKE SOLUTION. TNT WORKING STANDARDS PREPARED FROM 20 PPM STOCK SOLUTION. TNT EXTRACTS AND STANDARDS WERE COLOR DEVELOPED AND ANALYZED. THE CALIBRATION CURVE AND SAMPLE DATA IS REPORTED IN THE LABORATORY DATA NOTEBOOK.

5 ml RDX EXTRACTS WERE STORED IN THE COOLER OVERNIGHT FOR ANALYSIS ON 10/12/93.

INFLUENT SAMPLE COLLECTED AND EXTRACTED. 1 LITER OF SAMPLE WAS EXTRACTED. FILTRATE APPEARED YELLOW IN COLLECTION FLASK. THE SAMPLE'S INITIAL COLOR WAS YELLOW. THE FILTRATE COLOR COULD BE FROM OVERLOADING OF THE SPE CARTRIDGE.

Dave 10/11/93

10/12/93

CHEMISTS: DAVID WECHSLER (SEA) JOHNNA MOORE (SEA)

RDX WORKING STANDARDS WERE PREPARED AT 100, 250, 500, 1000 AND 5000 ug/L FOR THE CALIBRATION CURVE. A NEW 20 PPM WORKING STOCK WAS PREPARED. RDX EXTRACTS AND CALIBRATION STANDARDS WERE COLOR DEVELOPED ACCORDING TO THE METHOD SOP.

WATER ~~FM~~ FROM WELL 4-1 WAS COLLECTED AT THE INFLUENT SAMPLING PORT OF THE WATER TREATMENT SYSTEM. 50 ml OF SAMPLE WAS EXTRACTED THROUGH THE SPE CARTRIDGE. THE SAMPLE WAS EXTRACTED IN DUPLICATE ~~AND~~ INCLUDING MATRIX SPIKE AND MATRIX SPIKE DUPLICATE SAMPLES. THESE QC SAMPLES WERE EXTRACTED USING 50 ml OF SAMPLE. A 1 LITER SAMPLE OF METHOD BLANK AND METHOD BLANK SPIKE WERE EXTRACTED WITH THIS SAMPLE SET.

RDX AND TNT CONCENTRATIONS FROM WELL 4-1 AS REPORTED IN RI/FS REPORT, AUGUST, 1992, ARE 2700 AND 3400 ug/L, RESPECTIVELY.

$$RDX = 2700\,\mu g/L \times \frac{\overset{\text{ACTUAL VOL EXTR.}}{50\,ml}}{\underset{\text{THEOR. VOL. EXTRACT}}{1000\,ml}} \times \left(\frac{5\,ml}{10\,ml} \times \frac{1000\,ml}{25\,ml}\right) = 2700\,\mu g/L$$

$$TNT : 3400\,\mu g/L \times \frac{50\,ml}{1000\,ml} \times \left(\frac{5\,ml}{10\,ml} \times \frac{1000\,ml}{25\,ml}\right) = 3400\,\mu g/L$$

AFTER THE INITIAL 50 ml OF SAMPLE WAS EXTRACTED AN ADDITIONAL 150 ml OF DI WATER WAS ADDED TO THE SAMPLE CONTAINERS

AND PASSED THROUGH THE EXTRACTION CARTRIDGES.

RDX CALIBRATION CURVE WAS LINEAR, ALTHOUGH THE RESPONCES OF THE STANDARDS WERE APPROXIMATELY 1/2 OF THE PREVIOUS STANDARD RESPONCES. THIS IS POSSIBLY DUE TO POOR COLOR DEVELOPMENT.

PREPARED A 500 PPB TNT STANDARD AND REAGENT BLANK.

COLOR DEVELOPED ALL TNT EXTRACTS, ~~AND~~ STANDARD, AND REAGENT BLANK.

500 PPB TNT STANDARD WAS 14.8 %D FROM THE CALIBRATION CURVE (0.007 ABSORBANCE UNITS DIFFERENT FROM 500 PPB OF THE CURVE). WIDENING DAILY CONTINUING CALIBRATION QC WINDOW TO 30% D.

[illegible] 10/12/93

10/13/93

CHEMISTS : JOHNNA MOORE (SEA) DAVID WECHSLER

ES

PREPARED AND COLOR DEVELOPED NEW RDX CALIBRATION CURVE FROM

ANDARD RDX WORKING STOCK ~~#~~ FROM 10/12/93 :

ENT.

DATE #	STAND.	ANALYTE	STOCK	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC (ug/l)
10/13/93	5000	RDX	19.84 ug/ml	2.5	10	4960
↓	1000	↓	↓	0.5	↓	992
	500			0.25		496
	250			0.125		248
	100			0.050		99.2

AGENT

N

THE RDX COLOR DEVELOPMENT :

STD.	START	STOP
100	10:29	10:59
250	10:30	11:00
500	10:31	11:01
1000	10:32	11:02
5000	10:33	11:03
RB	10:34	11:04

BEGAN CONDITIONING SPE CARTRIDGES FOR FIRST SET OF SAMPLE EXTRACTIONS. ALL INFLUENT SAMPLES ~~FROM~~ FOR FIRST PUMP TEST WILL BE FROM WELL 4-1. THE INFLUENT SAMPLE WILL REQUIRE AN INITIAL DILUTION OF 1:20, 50 ml OF SAMPLE WILL BE EXTRACTED.

2/93

UV

D-153

SET SPE VACUUM MANIFOLD WITH 6 SPE EXTRACTION CARTRIDGES. EACH COLUMN WAS CONDITIONED WITH 10 ml ACETONE FOLLOWED BY 25 ml DI WATER. THE CARTRIDGES WERE ALLOWED TO STAND WITH WATER ON THE COLUMN UNTIL SAMPLE ELUTION BEGAN.

SAMPLE	QUANTITY	START TIME	FINISH TIME
MB 10/13	1 L	4:15	~~5~~ 6:15
BS 10/13	1L	4:15	6:17
100	50 ml	4:15	4:45
~~100~~ 101	50 ml	4:15	4:45
102	1L	4:15	6:07
103	1L	4:15	6:77

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	18:38	19:08
500	18:39	19:10
1000	18:40	19:11
MB	18:41	19:12
BS	18:42	19:13
#100	18:43	19:14
#101	18:44	19:16
#102	18:45	19:17
#103	18:46	19:18

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
~~RB~~ MB	19:41	20:01
~~500~~ 35	19:41	20:02
100	19:46	20:06
101	19:46	20:07
102	19:51	20:11
103	19:51	20:12
500	19:57	20:21
RB	19:57	20:21

DMW 10/13/93

UV
D-155

[redacted]

10/14/93

CHEMISTS: JOHANNA MOORE , DAVID WECHSLER

SETUP SPE VACUUM MANIFOLD TO EXTRACT 6 SAMPLES.
6 SPE CARTRIDGES WERE EACH CONDITIONED WITH 10 ml
OF ACETONE AND THEN 25 ml OF DI WATER.

SAMPLE	VOLUME EXTRACTED	EXTRACTION START TIME	EXTRACTION STOP TIME	EXTRACT COLOR
#104	50 ml	8:30	9:00	CLEAR YELLOW
#105	1L	8:30	10:15	CLEAR AMBER
#106	1L		10:15	CLEAR
#107	50 ml		9:00	CLEAR YELLOW
#108	1L		10:15	CLEAR AMBER
#109	1L		10:15	CLEAR

#105 EXTRACT WAS SPLIT AFTER BROUGHT TO 10 ml. TNT FRACTION WAS SPILLED. THE REMAINING EXTRACT WAS SPLIT AGAIN INTO 2 - 2.5 ml FRACTIONS. EACH FRACTION WAS BROUGHT TO ~~10.5~~ 12.5 ml FINAL VOLUME.

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	11:17	
500	↓	
#104	11:21	
#105	↓	
#106	11:26	
#107	↓	
#108	11:31	
#109	↓	

SETUP 8 SPE EXTRACTION CARTRIDGES FOR EXTRACTION.
EACH SPE CARTRIDGES WAS CONDITIONED WITH 10 ml OF
ACETONE AND 2 25 ml ALIQUOTS OF DI WATER

SAMPLE	VOLUME	START TIME	STOP TIME	EXTRACT COLOR
#110	50 ml	11:00	11:30	CLEAR YELLOW
#111	1 L	↓	~~1~~13:20	CLEAR AMBER
#112	1 L	↓	13:20	CLEAR
#113	50 ml	↓	11:30	CLEAR YELLOW
#114	1 L	↓	12:30	CLEAR AMBER
#115	1 L	↓	13:20	CLEAR
MB	1 L	12:05	13:20	CLEAR
BS*	1 L	↓	13:15	CLEAR PINK

* 1 ml OF 25 PPM SPIKING SOLUTION ADDED TO
SAMPLE BEFORE EXTRACTION.

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	12:52	13:23
500	12:53	13:24
#104	12:54	13:25
#105	12:55	13:27
#106	12:56	13:28
#107	12:57	13:29
#108	12:58	13:30
#109	12:59	13:31

UV
D-157

TNT COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	15:00	15:20
500	↓	↓
MB	15:05	15:25
BS	↓	↓
110	15:10	15:30
111	↓	↓
112	15:15	15:35
113	↓	↓
114	15:20	15:40
115	↓	↓

SETUP 9 SPE ~~EXT~~ CARTRIDGES FOR EXTRACTION ON VACUUM MANIFOLD. COLUMNS WERE CONDITIONED WITH 10 ml ACETONE EACH AND 2 25 ml ALIQUOTS OF ~~of~~ DI WATER.

Sample	Volume Extracted	Start Time	Stop Time	Extract Color
#116	50 ml	15:55	16:30	
#117	1 L		18:00	
#118	1 L		18:15	
#119	50 ml		16:30	
#120	50 ml		16:30	
#120 SD*	50 ml	↓	16:30	
121	1 L	16:40	18:40	
122	1 L		18:40	
UV105	1 L	↓	18:40	

[redacted]

* SAMPLE SPIKED WITH 1 ml OF 25 PPM SPIKING SOLUTION BEFORE EXTRACTION

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
500	17:28	17:58
RB	17:29	17:59
MB	17:30	18:00
BS	17:31	18:01
110	17:32	18:02
111	17:33	18:04
112	17:34	18:05
113	17:35	18:06
114	17:36	18:07
115	17:37	18:08

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	19:43	20:03
500	↓	20:04
#105	19:47	20:05
#106	↓	20:06
#117	19:53	20:07
#118		20:08
#119		20:09
#120	↓	20:10
#120ms	19:58	20:11
#121		20:12
#122	↓	20:13

UV

D-159

[redacted]

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	20:24	20:54
500	20:25	20:55
#105	20:26	20:56
#116	20:27	20:57
#117	20:28	20:58
#118	20:29	20:59
#119	20:30	21:00
#120	20:31	21:01
#120 MS	20:32	21:02
#121	20:33	21:03
#122	20:34	21:05

UV
D-160

10/14/93

[redacted]

10/15/93

CHEMISTS: JOHANNA MOORE (SEA), DAVID WECHSLER (SEA)

PREPARED NEW 20 PPM RDX STOCK USING 2 ml OF 992 ug/ml STOCK CONCENTRATION. FINAL VOLUME 100 ml IN ACETONE.

PREPARED NEW RDX CALIBRATION CURVE:

STANDARD SOL.	STOCK CONC.	ALIQUOT	FINAL VOLUME	FINAL CONC. (ug/L)
100 PPB	19.84 ug/ml	50 ul	10 ml	99.2
250 PPB	↓	125 ul	↓	248
500 PPB	↓	250 ul	↓	496
1000 PPB	↓	500 ul	↓	992
5000 PPB	↓	2500 ul	↓	4960

RDX COLOR DEVELOPMENT

# SAMPLE	START	STOP
RB	10:35	11:05
100 PPB	10:36	11:06
250 PPB	10:37	11:07
500 PPB	10:38	11:08
1000 PPB	10:39	11:09
5000 PPB	10:41	11:11

SETUP SPE VACUUM MANIFOLD SYSTEM TO EXTRACT 6 SAMPLES. EACH CARTRIDGE WITH 10 ml ACETONE AND 2-25 ml ALLIQUOTS OF DI WATER.

UV

D-161

SAMPLE	VOLUME EXTRACTED	START TIME	STOP TIME	SAMPLE COLOR
#123	50 ml	12:10	12:45	LIGHT YELLOW
#124	1L		13:52	CLEAR
#125	1L		13:58	CLEAR
#126	50 ml		12:50	LIGHT YELLOW
#127	1L		14:05	CLEAR
#128	1L		14:06	CLEAR

RDX CALIBRATION CURVE * COLOR DEVELOPED AGAIN.

SAMPLE	START	STOP
RB	12:31	12:56
100	12:32	12:57
250	12:33	12:58
500	12:34	12:59
1000	12:35	13:00
5000	12:36	13:00

* RDX COLOR DEVELOPMENT TIME REDUCED FROM 30 MINUTES TO 25 MINUTES.

SAMPLE RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
123	16:01	16:25
124	16:03	16:27
125	16:04	16:28
126	16:05	16:29
127	16:06	16:31
128	16:09	16:34
RB	15:59	16:24

TNT COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	17:20	17:40
500	17:25	17:45
123	17:29	17:49
124	↓	17:50
125	~~17~~ 17:34	17:54
126	↓	17:55
127	17:38	17:58
128	↓	17:59

SETUP SPE VACUUM MANIFOLD SYSTEM FOR ~~6~~ 5 SAMPLES. EACH CARTRIDGE WAS CONDITIONED WITH 10 ml ACETONE AND 2 - 25 ml ALIQUOTS OF DI WATER.

SAMPLE	VOLUME EXTRACTED	START TIME	STOP TIME	SAMPLE APPEARANCE
MB 10/15	1 L	17:05	19:10	—
BS 10/15*	1L		19:15	—
#129	50 ml		17:47	LIGHT YELLOW
#130	1L		18:57	CLEAR
#131	1L	↓	19:02	CLEAR

UV

D-163

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	19:45	20:05
500	↓	20:06
MB	19:50	20:10
BS	↓	20:11
129	19:55	20:15
130		20:16
131	↓	20:17

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	~~20:26~~ 20:27	20:52
500	20:28	20:54
MB	20:29	20:55
BS	20:30	20:56
129	20:31	20:58
130	20:32	20:59
131	20:33	21:00

10/15/93 [signature]

10/16/93

CHEMISTS: DAVID WECHSLER (SEA), JOHNNA MOORE (SEA)

SETUP SPE VACUUM MANIFOLD TO EXTRACT 11 SAMPLES. EACH EXTRACTION CARTRIDGE WAS CONDITIONED WITH 10 ml ACETONE AND 2 - 25 ml ALIQUOTS OF DI WATER.

SAMPLE	VOLUME EXTRACTED	START TIME	STOP TIME	SAMPLE COLOR
# 132	50 ml	8:15	8:45	CLEAR YELLOW
133	1L	8:20	10:10	CLEAR
134	1L	↓	10:40	CLEAR
135	50 ml	8:15	8:45	CLEAR YELLOW
136	1L	8:30	10:10	CLEAR
137	1L	↓	10:55	CLEAR
138	50 ml	8:25	9:00	CLEAR YELLOW
139	1L	8:30	10:10	CLEAR
140	1L	9:25	10:55	CLEAR
141	1L	↓	↓	CLEAR
141 SD*	1L			CLEAR

* 1 ml OF 25 PPM SPIKE SOLUTION ADDED TO SAMPLE BEFORE EXTRACTION.

ANALYTE	DATE	STOCK CONC (mg/ml)	STD	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC
RDX	10/16/93	992	20 PPM	0.200	10	19.84 ug/ml
RDX	↓	19.84	500 PPB	0.250	↓	496 ug/L
TNT	↓	19.76	500 PPB	0.250	↓	494 ug/L

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	12:25	12:50
500	12:26	12:51
132	12:27	12:52
133	12:28	12:53
134	12:29	12:54
135	12:30	12:55
136	12:31	12:56
137	12:32	12:57
138	12:33	12:58
139	12:34	12:59
140	12:35	13:01
141	12:36	13:02
141 SD	12:37	13:03

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	14:49	15:10
500		15:11
132		15:12
133		15:13
134	14:54	15:14
135		15:15
136		15:16
137		15:17
138	15:00	15:20
139		15:21
UV 140		15:22
D-166 141		15:23
141 SD		15:24

[redacted]

SETUP SPE VACUUM MANIFOLD SYSTEM TO EXTRACT 11 SAMPLES.
EACH SPE CARTRIDGE WAS CONDITIONED 10 ml OF ACETONE AND
2 - 25ml ALIQUOTS OF DI WATER

SAMPLE	VOLUME EXTRACTED	START TIME	STOP TIME	SAMPLE COLOR
142	50ml	12:30	13:05	YELLOW
143	1L		15:05	CLEAR
144	1L		15:00	CLEAR
145	50ml		13:05	YELLOW
146	1L		15:15	CLEAR
147	1L		14:15	CLEAR
148	50ml		13:05	YELLOW
149	1L		15:15	CLEAR
150	1L	13:45	15:15	CLEAR
MB	1L		15:15	CLEAR
BS	1L		15:15	CLEAR

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
PB	17:31	17:57
500	17:32	17:58
MB	17:33	17:59
BS	17:33	18:00
142	17:34	18:01
143	17:34	18:02
144	17:36	18:03
145	17:37	18:04
146	17:38	18:05
147	17:39	18:06
148	17:40	18:08
149	17:41	18:09
150	17:42	18:10

UV
D-167

[redacted]

TNT COLOR DEVELOPMENT:

SAMPLE	START	STOP
BS	18:39	18:59
MB	18:39	19:00
RB	18:45	19:05
500		19:06
142		19:07
143		19:08
144		19:09
145		19:10
146	18:50	19:12
147		19:13
148		19:14
149		19:15
150		19:16

DMW 10/16/93

10/17/93

CHEMISTS: JOHANNA MOORE (SEA) DAVID WECHSLER (SEA)

SETUP SPE VACUUM MANIFOLD TO EXTRACT 11 SAMPLES. EACH SPE CARTRIDGE WAS CONDITIONED WITH 10 ml ACETONE AND 2 - 25 ml ALIQUOTS OF DI WATER

SAMPLE	VOLUME EXTRACTED	START	STOP	SAMPLE COLOR
151	50	8:55	9:30	YELLOW
152	1000	9:00	10:45	CLEAR
153	1000	↓	10:45	CLEAR
154	50	↓	9:30	YELLOW
155	1000	↓	11:00	CLEAR
156	1000	8:55	10:30	CLEAR
157	50	9:00	9:30	YELLOW
158	1000	↓	10:30	CLEAR
159	1000	9:45	11:05	CLEAR
160	50	↓	10:15	CLEAR
161	1000	↓	11:05	CLEAR

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	12:31	12:56
500	12:32	12:57
151	12:33	12:58
152	12:34	12:59
153	12:35	13:00
154	12:36	13:01

UV

D-169

RDX COLOR DEVELOPMENT - CON'T.

SAMPLE	START	STOP
155	12:37	13:02
156	12:38	13:03
157	12:39	13:04
158	12:40	13:05
159	12:41	13:06
160	12:42	13:07
161	12:43	13:08

SETUP SPE VACUUM MANIFOLD TO EXTRACT 9 SAMPLES. EACH EXTRACTION CARTRIDGE WAS CONDITIONED WITH 10 ml OF ACETONE AND 2 - 25 ml ALIQUOTS OF DI WATER.

SAMPLE	VOLUME EXTRACTED	START TIME	STOP TIME	SAMPLE COLOR
167	50 ml	15:13	15:40	
168	1L		17:20	
169	1L		17:15	
170	50ml		16:00	
171	1L		17:25	
172	1L		17:10	
173	50ml		15:45	
174	1L		16:55	
175	1L	16:00	17:40	

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
MB	11:22	11:42
500	↓	11:43
151		11:44
152		11:45
153	11:27	11:47
154	↓	11:48
155		11:49
156		11:50
157		11:51
158	11:32	~~12:00~~ 11:52
159	↓	11:53
160		11:54
161		11:55

SETUP SPE ~~AF~~ VACUUM MANIFOLD TO EXTRACT 8 SAMPLES EACH EXTRACTION CARTRIDGE WAS CONDITION WITH 10 ml OF ACETONE AND 2-25ml ALIQUOTS OF DI WATER.

	SAMPLE	VOLUME EXTRACTED	START TIME	STOP TIME	SAMPLE COLOR
	MB	1 L	12:14	13:20	CLEAR
	BS*	1 L	↓	13:45	CLEAR
	162	1L	12:13	13:45	CLEAR
	162SD*	1L	12:10	13:40	CLEAR
	163	1L	↓	13:40	CLEAR
UV	164	50ml	12:15	12:35	LIGHT YELLOW
D-171	165	1L	12:11	14:00	CLEAR
	166	1L	12:13	14:07	CLEAR

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
MB	14:00	14:20
BS		14:21
RB		14:22
500		14:23
162	14:05	14:25
162 SD		14:26
163		14:27
164	14:10	14:30
165		14:31
166		14:32

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	17:07	17:32
500	17:08	17:33
MB	17:09	17:34
BS	17:10	17:35
162	17:11	17:36
162SD	17:12	17:37
163	17:13	17:38
164	17:14	17:39
165	17:15	17:40
166	17:16	17:41

TNT Color Development

Sample	Start	Stop
500	19:27	19:47
169		19:48
167		19:49
168		19:50
171	19:31	19:51
170		19:52
RB		19:53
172		19:54
175	19:33	19:55
173		19:56
174		19:57

RDX Color Development

Sample	Start	Stop
500	19:59	20:24
RB	20:00	20:25
167	20:01	20:26
168	20:02	20:27
169	20:03	20:28
170	20:04	20:29
171	20:05	20:30
172	20:06	20:31
173	20:07	20:32
174	20:08	20:33
175	20:09	20:34

UV

D-173

DMW 10/17/93

10/18/93

CHEMISTS: DAVID WECHSLER (SEA), ~~[illegible]~~ JOHANNA MOORE (SEA)

SETUP SPE VACUUM MANIFOLD TO EXTRACT 13 SAMPLES. EACH SPE CARTRIDGE WAS CONDITIONED WITH 10 ml OF ACETONE AND 2-25ml ALIQUOTS OF D.I WATER.

SAMPLE	VOLUME EXTRACTED	START	STOP	SAMPLE COLOR
176	50 ml	~~[illegible]~~ 10:45	11:10	YELLOW
177	1L	~~[illegible]~~	12:55	CLEAR
178	1L	~~12:55~~	12:55	CLEAR
179	50ml	~~11:15~~	11:15	YELLOW
180	1L	~~13:30~~	13:30	CLEAR
181	1L	~~13:30~~	13:30	CLEAR
182	50ml	~~13:40~~	13:40	YELLOW
183	50ml		11:15	YELLOW
183 SD*	50ml	11:20	11:50	YELLOW
M8	1L	11:35	13:20	CLEAR
BS*	1L	12:02	14:00	CLEAR
184	1L	11:35	13:55	CLEAR
185	1L	11:27	13:17	CLEAR

* 1ml OF 25 PPM SPIKING SOLUTION ADDED BEFORE EXTRACTION.

STANDARD SOLUTIONS

ANALYTE	STD	LOT #	STOCK CONC. (ug/ml)	ALIQUOT (ml)	FINAL VOLUME (ml)	FINAL CONC.
TNT	20 PPM STOCK	ACCUSTANDARD #083-223	1004	1	50	20.08 ug/ml
RDX	20 PPM STOCK	ACCUSTANDARD #083-242	1074	1	↓	21.48 ug/ml
↓	100 PPB	—	21.48	0.050	10	107.4 ug/L
	250 PPB	—	↓	0.125	↓	268.5 ug/L
	500 PPB	—		0.250		537 ug/L
	1000 PPB	—		0.500		1074 ug/L
	5000 PPB	—		2.5		5370 ug/L

RDX COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	14:10	14:35
100	14:11	14:36
250	14:12	14:37
500	14:13	14:38
1000	14:14	14:39
5000	14:15	14:41
MB	14:16	14:43
BS	14:17	14:44
176	14:18	14:45
177	14:19	14:46
178	14:20	14:48
179	14:21	14:49
180	14:22	14:50
181	14:24	14:51
182	14:25	14:52
183	14:26	14:53
183 SD	14:27	14:54
18~~3~~4/~~SD~~	14:28	14:56
185	14:29	14:57

UV

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TNT Color Development

Sample	Start	Stop
RB	16:19	16:39
176		16:40
177		16:41
178		16:42
179	16:31	16:51
180	16:25	16:45
181		16:46
182		16:47
183		16:48
183SD	16:31	16:52
184		16:53
185		16:54
MB	16:36	16:56
BS		16:57
500		16:58

UV
D-176

DMW 10/18/93

[redacted]

10/19/93

CHEMISTS: JOHANNA MOORE, DAVID WECHSLER

SETUP SPE VACUUM MANIFOLD TO EXTRACT 13 SAMPLES. EACH CARTRIDGE WAS CONDITIONED WITH 10ml of ACETONE AND 2 - 25ml ALIQUOTS OF DI WATER.

SAMPLE	VOLUME EXTRACTED	START	STOP	SAMPLE COLOR
186	50ml	9:20	9:45	YELLOW
187	1L		11:58	CLEAR
188	1L		11:50	CLEAR
189	50ml		9:38	YELLOW
190	1L	10:20	12:45	CLEAR
191	1L	9:20	12:27	CLEAR
192	50ml	9:20	9:43	YELLOW
193	1L	10:20	12:42	CLEAR
194	1L	10:20	13:20	CLEAR
BS*	1L	9:20	11:50	CLEAR
BSD*	1L		12:00	CLEAR
MB	1L	13:30	14:30	CLEAR
178RE	1L	13:30	14:30	CLEAR

* 1 ml of 25 PPM SPIKE SOLUTION ADDED BEFORE EXTRACTION.

TNT Color Development

Sample	Start	Stop
RB	16:03	16:23
500		16:24
QB		16:25
BS		16:26
BSD		16:27
186	16:08	16:28
187		16:29
188		16:30
189		16:31
190		16:32
191	16:13	16:33
192		16:34
193		16:35
194		16:36
178RE		16:37

RDX Color Development

Sample	Start	Stop
RB	17:40	18:06
500	17:41	18:07
QB	17:42	18:08
BS	17:43	18:09
BSD	17:44	18:10
186	17:45	18:11
187	17:46	18:12

UV
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ROX CO CON'T.

SAMPLE	START	STOP
188	17:48	18:13
189	17:49	18:14
190	17:50	18:15
191	17:51	18:16
192	17:52	18:17
193	17:53	18:18
194	17:54	18:19
178RE	17:55	18:20

UV
D-179

Dmd 10/19/93

END OF BOOK #1 - SEE BOOK #2

DMW 10/27/93

RECYCLED PAPER · PAPIER RECYCLÉ

#2

Dames & Moore
1750 S. W. Harbor Way
Suite 400
Portland, Oregon 97201

Field Laboratory Notebook #2
Field Sampling for TNT & RDX
UMDA - Hermiston, OR
10/27/93 to 11/3/93

POSTMASTER
RETURN IF NOT DELIVERED
RETURN POSTAGE GUARANTEED
215.15 PDX

BLUELINE

A82
Record
Registre

UV
D-181

10/27/93

CHEMISTS: JOHNNA MOORE (SEA) DAVID WECHSLER (SEA)

RPX INTERMEDIATE STOCK SOL: 21.48 ug/ml

5000 PPB 21.48 ug/ml × $\frac{2.5ml}{10}$ = 537.0

1000 PPB 21.48 ug/ml × $\frac{.5ml}{10}$ = 107.4

500 PPB 21.48 ug/ml × $\frac{.25}{10}$ = 537

250 PPB 21.48 ug/ml × $\frac{.125}{10}$ = 268.5

100 PPB 21.48 ug/ml $\frac{.050}{10}$ = 107.4

RDX WORKING STANDARD SOL

DATE	ANALYTE	STD	ug/ml STOCK CONC ug/ml	(ml) ALIQUOT	(ml) FINAL (V)	FINAL (C)
10/27/93	RDX	20ppm ~~21.48 ppm~~	21.48			
		5000 PPB	21.48	2.5	10	537.0
		1000 PPB		.5		107.4
		500 PPB		.25		537
		250 PPB		.125		268.5
		100 PPB		.050		107.4

ADDED 300 ~~3~~ ul of H_2O to EACH STANDARD.

TNT STANDARD SOL

DATE	STD	ALIQUOT (ml)	STOCK CONC (ug/ml)	FINAL VOLUME (ml)	FINAL CONC (ug/L)
10/27/93	5000 PPB	12.5	20.08	50	5020
	1000 PPB	2.5			100.4.
	500 PPB	1.25			50.2.
	250 PPB	.625 ~~.625~~			25.1.
	100 PPB	.250			10.04

ADDED 1.5ml OF H_2O to EACH STANDARD

UV

D-182

02

RDX STANDARDS COLOR DEVELOPMENT:

SAMPLE	START TIME	FINISH TIME
RB	14:07	14:32
100	14:08	14:33
250	14:09	14:34 ~~14:35~~
500	14:10	14:35
1000	14:11	14:36
5000	14:12	14:37

RDX COLOR DEVELOPMENT: ≈0.4g Zn DUST IN A 10 ml SYRINGE; 5ml OF ACIDIFIED STANDARD IS POURED INTO THE SYRINGE AND ALLOWED TO REMAIN IN CONTACT WITH THE Zn FOR ABOUT 15 SECONDS. THE SOLUTION IS THEN FILTERED INTO 20ml OF DI WATER CONTAINING 1 NITRIVER 3 POWDER PILLOW. THE SOLUTION COLOR DEVELOPS FOR 25 MINUTES UPON ADDITION TO THE DI WATER SOLUTION. AT THE END OF COLOR DEVELOPMENT THE SOLUTION IS FILTERED INTO A CLEAN VIAL AND READ ON THE SPECTROPHOTOMETER. THE REAGENT BLANK (RB) IS HANDLED IN THE SAME MANNER AS THE STANDARDS, EXCEPT THE RB IS 5ml OF ACETONE ACIDIFIED WITH 500 ml OF ACETIC ACID.

REAGENT BLANK AFTER COLOR DEVELOPMENT HAS VISIBLY ~~DETECTED~~ DETECTABLE TINT OF COLOR. ANALYZED STANDARDS WITH REAGENT BLANK IN REFERENCE POSITION AND AUTOZEROED THE INSTRUMENT WITH THE REAGENT BLANK. THE 250 PPB AND 1000 PPB STANDARDS NOT DIRECTLY LINEAR WITH THE OTHER POINTS OF THE CURVE. PREPARE NEW 250 PPB AND 1000 PPB STANDARDS AND REANALYZE. A NEW BOTTLE OF Zn WAS USED AND THE STANDARDS COLOR DEVELOPED BETTER THAN OF 10/17, 10/18 AND 10/19. Zn THAT HAD BEEN LEFT UNCAPPED WAS USED THEN.

UV

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~~RDX~~ TNT INTERMEDIATE STOCK SOL: 20.08 ug/ml

5000	PPB	20.08 ug/ml × $\frac{12.5\text{ ml}}{50}$	=	502
1000	PPB	20.08 ug/ml × $\frac{2.5}{50}$	=	100.4
500	PPB	20.08 ug/ml × $\frac{1.25}{50}$	=	50.2
250	PPB	20.08 ug/ml × $\frac{.625}{50}$	=	25.1
100	PPB	20.08 ug/ml × $\frac{.250}{50}$	=	10.04

TNT COLOR DEVELOPMENT

PLACED 25ml OF 100, 250, 500, 1000 + 5000 PPB TNT SOLUTION INTO SEPERATE VIALS CONTAINING ≈ 3g SODIUM SULFITE AND 1 KOH PELLET. SHOOK EACH VIAL FOR 3 MIN AND ALLOWED TO SIT FOR 20 MIN.

SAMPLE	START TIME	FINISH TIME
RB	3:06	3:26
100	3:12	3:32
250	3:12	3:32
500	3:12	3:32.
1000	3:06	3:26
5000	3:06	3:26

RDX COLOR DEVELOPMENT:

SAMPLE	START TIME	FINISH TIME
250	15:31	15:56
1000	15:32	15:57

UV
D-184

POOR COLOR DEVELOPMENT.

[redacted]

NEW RDX WORKING STANDARDS FOR 1000 PPB AND 250 PPB WERE PREPARED WITH A REAGENT BLANK. THE 250 PPB AND 1000 PPB STANDARDS WERE PREPARED EXACTLY AS DESCRIBED ON PG. 1.

RDX COLOR DEVELOPMENT

SAMPLE	START TIME	STOP TIME
RB	17:17	17:42
250	17:18	17:43
1000	17:19	17:44

STANDARDS READ HIGHER ABSORBANCE VALUES THAN THE PREVIOUS 2 SETS OF 250 AND 1000 PPB STANDARDS. USE THESE 250 PPB AND 1000 PPB STANDARDS FOR THE RDX CALIBR~~ATION~~ CURVE.

DWW 10/27/93

10/28/93

CHEMISTS: DAVID WECHSLER (SEA) JOHNNA MOORE (SEA)

SETUP SPE VACUUM MANIFOLD FOR EXTRACTION OF 8 SAMPLES. COLUMNS WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25ml ALIQUOTS OF DI WATER.

SAMPLE	VOLUME EXTRACTED	EXTRACTION START TIME	EXTRACTION FINISH TIME	INITIAL COLOR	EXTRACT COLOR
195	~~1000~~ 50 ml	09:30	~~[illegible]~~ 10:07	YELLOW	
196	1000 ml	09:30	11:29	CLEAR	
197		09:30	11:24	CLEAR	
198		09:30	11:36	CLEAR	
198 MS		09:30	11:17	CLEAR	
1		09:30	11:14	LIGHT YELLOW	
2		09:30	11:34	LIGHT YELLOW	
3		09:30	11:36	CLEAR	

1 ml OF MATRIX SPIKE SOLUTION ~~#~~ WAS USED TO FORTIFY ~~II~~ 198 MS.

COLOR OF FILTRATE WATER IS SLIGHTLY YELLOW INDICATING POSSIBLE SPE CARTRIDGE OVERLOADING FROM THE 2 UNDILUTED INFLUENT SAMPLES.

SAMPLE # 1 AND # 2 ARE INFLUENT SAMPLES

UV

D-186

PREPPED 500ppb OF TNT AND RDX IN SEPERATE VOL FLASK:

TNT - .25ml OF 21.48 ug/ml RDX solution, ADDED 300ul OF H_2O AND FILLED TO 10ml OF VOL FLASK W/ ACETONE

RDX - 1.25ml OF 20.08 ug/ml TNT Solution, ADDED 1.5ml OF H_2O

COLOR DEVELOPED TNT SAMPLES BY ADDING 750ul of H_2O to 5ml OF EXTRACTION AND FILLING VOA AMBER BOTTLES TO 25ml. SYRINGED SOLUTION INTO SEPERATE VOA AMBER VIALS CONTAINING 1 PELLET OF KOH & ≈ 3g OF SODIUM SULFITE. SHOOK FOR 3 MIN. ALLOWED SAMPLES TO SIT 20MIN AS FOLLOWS.

SAMPLE #	TIME START	TIME STOP
500ppb TNT	12:50	12:10
RB TNT	12:50	12:10
#1	12:50	12:10
#2	12:50	12:10
#3	12:56	1:16
#195	12:56	1:16
#196	12:56	1:16
#197	12:56	1:16
#198	1:03	1:23
#198SD	1:03	1:23

SAMPLES #1 AND #2 RDX FRACTION WERE DILUTED BY A FACTOR OF ~~1:10~~ 1:100 (50ul → 5ml) AFTER THE ACETONE EXTRACT WAS SPLIT INTO 2 5ml FRACTIONS.

SETUP SPE VACUUM MANIFOLD FOR 8 SAMPLES. CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25 ml ALIQUOTS OF DI WATER.

SAMPLE	EXTRACTION VOLUME	EXTRACTION START TIME	EXTRACTION FINISH TIME	SAMPLE COLOR
MB 10/28	1000 ml	13:50	15:28	CLEAR
BS 10/28	1000 ml	13:50	15:41	CLEAR
#4	1000 ml	13:50	16:02	CLEAR
#5	250 ml	13:50	14:36	LIGHT YELLOW
#6	1000 ml	13:50	15:29	CLEAR
#7	1000 ml	13:50	15:39	CLEAR
#8	250 ml	13:50	14:57	LIGHT YELLOW
#9	1000 ml	13:50	16:06	CLEAR

BS 10/28 WAS FORTIFIED WITH 1 ml OF MATRIX SPIKE SOLUTION.

ROX COLOR DEVELOPMENT

	TIME ST	TIME STOP
500 ppb	3:20	3:45
RB	3:22	3:47
1	3:23	3:48
2	3:24	3:49
3	3:25	3:50
195	3:26	3:51
196	3:26	3.51
197	3:27	3:53
198	3:29	3:54
198SD	3:30	3:55

ACTOR

UV

D-188

[redacted]

08

RDX COLOR DEVELOPMENT

	START	STOP
RB RDX	5:35	6:00
500ppm RDX	5:36	6:01
RB RDX	5:37	6:02
BS	5:39	6:04
4	5:40	6:05
5	5:41	6:06
6	5:42	6:07
7	5:43	6:08
8	5:44	6:09
9	5:45	6:10

SAMPLES #5 AND #8 - WERE DILUTED BY A FACTOR OF 5 (1ml → 5ml) AFTER THE ACETONE EXTRACT WAS SPLIT INTO 2 5ml FRACTIONS.

TNT COLOR DEVELOPMENT	START	STOP
500 ppb TNT	18:35	18:57
RB	18:35	18:57
MB	18:35	18:57
BS	18:42	19:04 ~~18:4~~
#4	18:42	19:04
#5	18:42	19:04
#6	18:42	19:04
#7	18:47	19:06
#8	18:47	19:08
#9	18:47	19:08

DMW 10/28/93

UV
D-189

10/29/93

EXTRACTION: SET UP SPE VACUUM METHOD FOR 8 SAMPLES. CARTRIDGES WERE CONDITIONED WITH 10ml OF ACETONE AND 2x25ml OF DI H_2O.

SAMPLE	TIME START	TIME STOP	VOLUME	COLOR
10	8:15	10:06	1L	CLEAR
11	↓	8:58	250ml	YELLOW
12	↓	10:15	1L	CLEAR
13	↓	10:15	1L	CLEAR
14	↓	8:50	250ml	YELLOW
15	↓	10:15	1L	CLEAR
16	↓	10:10	1L	CLEAR
17	↓	8:58	250ml.	YELLOW.

AFTER EXTRACTION EACH CARTRIDGE WAS RINSED WITH 25ml OF DI H_2O.
COLOR OF FILTRATE WATER IS SLIGHTLY YELLOW

EXTRACTION: SET UP SPE VACUUM METHOD FOR 8 SAMPLES.
CARTRIDGES WERE CONDITIONED W/ 10 ml OF ACETONE AND 2x25ml OF DI H_2O.

SAMPLE	TIME START	TIME STOP	VOLUME	COLOR
18	11:15	1:25	1L	CLEAR
19	↓	1:25	1L	CLEAR
20	↓	11:55	250ml	YELLOW
21	↓	11:55	250ml	YELLOW
21SD	↓	11:50	250ml	YELLOW
22	↓	1:05	1L	CLEAR
23	↓	1:25	1L	CLEAR
24	↓	11:50	250ml	YELLOW

21SD WAS FORTIFIED W/ 1ml OF RDX/TNT MATRIX SPIKE SOLUTION

UV

D-190

PREPARED TNT 500 PPB STANDARD FROM 20.08 mg/ml STOCK SOLUTION. USED 1.25 ml OF STOCK INTO FINAL VOLUME OF 50ml. 1.5ml OF WATER WAS ADDED FOR PROPER COLOR DEVELOPMENT

TNT COLOR DEVELOPMENT

SAMPLE	TIME START	STOP
RB	11:43	12:03
500	↓	12:04
10	↓	12:04
11	↓	12:05
12	11:48	~~10:~~ 12:13
13	↓	12:13
14	↓	12:12
15	11:54	12:14
16	↓	12:15
17	↓	12:15

PREPARED 500 PPB RDX STANDARD FROM 21.48 STOCK SOLUTION. A 0.25 ml ALIQUOT OF STOCK SOLUTION IN A FINAL VOLUME 10 ml. 0.3ml OF WATER WAS ADDED FOR PROPER COLOR DEVELOPMENT

CK

RDX COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	13:06	13:39
500	13:07	13:40
#10	13:08	13:41
11	13:09	13:42
12	13:10	13:43
13	13:10	13:44
14	13:11	13:45
15	13:11	13:46
16	13:12	13:47
17	13:13	13:48

PRECEEDING TNT AND RDX ANALYSES WERE PEFORMED IN CLEAR VIALS.

EXTRACTION: SET UP SPE VACUUM METHOD FOR 8 SAMPLES. CARTRIDGES WERE CONDITIONED WERE CONDITIONED W/ 10ml OF ACETONE AND 2 X 25ml OF DI H_2O

SAMPLE	START	STOP	VOLUME	COLOR
25	2:25	4:15	1L	CLEAR
26		4:25	1L	CLEAR
27		3:50	250ml	YELLOW
28		4:15	1L	CLEAR
29		3:50	1L	CLEAR
30		3:50	250ml	YELLOW
MB		4:25	1L	CLEAR
BS		4:25	1L	CLEAR

LON.

OPMENT.

UV

D-192

BS WAS FORTIFIED W/ 1 ml OF RDX/TNT MATRIX SPIKE SOLUTION.

PREPARED 500 PPB RDX STANDARD:

0.25 ml of 21.48 ug/ml STOCK INTO FINAL VOLUME OF 10 ml

300 ml OF WATER ADDED.

~~TNX~~ COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	15:00	15:27
500	15:01	15:28
18	15:02	15:29
19	15:03	15:30
20	15:04	15:30
21	15:05	15:31
22 SD	15:06	15:32
22	15:07	15:33
23	15:08	15:33
24	15:09	15:34

~~RDX~~ TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	16:18	16:40
500	↓	16:40
18		16:41
19		16:41
20	16:23	
21	↓	
21 MS		
22	16:28	
23	↓	
24		

UV

D-193

DMW 10/28/93

10/30/93

CHEMISTS: JOHANNA MOORE (SEA) DAVID WECHSLER (SEA)

SETUP SPE VACUUM MANIFOLD FOR 8 SAMPLES. THE SPE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25 ml ALIQUOTS OF WATER.

SAMPLE #	TIME START	TIME STOP	VOL. EXTRACTED	SAMPLE COLOR
31	8:40	10:58	1000 ml	CLEAR
32		10:53	1000 ml	CLEAR
33		9:44	250 ml	LIGHT YELLOW
34		10:46	1000 ml	CLEAR
35		11:14	1000 ml	CLEAR
36		10:04	250 ml	LIGHT YELLOW
37		11:32	1000 ml	CLEAR
38		10:56	1000 ml	CLEAR

TNT COLOR DEVELOPMENT

SAMPLE	TIME START	TIME STOP
RB	12:16	12:36
500		
31		
32		
33	12:25	12:48
34		
35		
36		
37	12:31	

UV
D-194

38 12:31 12:51 ↓

SETUP SPE VACUUM MANIFOLD TO EXTRACT 8 SAMPLES.
THE SPE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETON
AND 2 - 25 ml ALIQUOTS OF WATER

SAMPLE	VOLUME EXTRACTED	TIME START	TIME STOP	COLOR
MB 10/30	1000 ml	12:42	15:04	CLEAR
BS 10/30	1000 ml	↓	14:37	CLEAR
39	250 ml	↓	13:15	LIGHT YELLOW
40	1000 ml	↓	14:31	CLEAR
41	1000 ml	↓	15:02	CLEAR
42	1000 ml	↓	14:50	CLEAR
42 MS	1000 ml	↓	15:07	CLEAR
43	250 ml	↓	13:29	LIGHT YELLOW

RDX COLOR DEVELOPMENT	TIMES START	TIME STOP
RB	1:46	2:11
600 ppb	1:46	~~2:12~~ 2:11
31	1:47	~~2:13~~ 2:12
32	1:48	~~2:14~~ 2:13
33	1:49	2:14
34	1:50	2:15
35	1:51	2:16
36	1:52	2:17
37	1:53	2:18
38	1:55	2:20

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	4:07	4:32
500ppb	4:06	4:33
BS 10/30	~~4:07~~ 4:08	4:34
MB 10/30	~~4:08~~ 4:09	4:35
39	4:09	4:36
40	4:10	4:37
41	4:11	4:38
42	4:12	4:39
42ms	4:13	4:40
43	4:14	4:41

ACNTO STK

TNT COLOR DEVELOPMENT

RB	4:09	4:29
500		
MB		
BS		
39	4:13	4:33
40		
41		
42	4:15	4:35
42MS		
43		

UV
D-196

10/31/93

SET UP SPE VACUUM METHOD FOR 8 SAMPLES
EXTRACTION: CARTRIGES WERE CONDITIONED WITH 10ml ACETONE AND 2x25 ml DI H_2O

SAMPLE	START	STOP.	VOLUME	COLOR
44	0900	10:30	1L	CLEAR
45		10:30	1L	CLEAR
46		9:45	250ml	LT YELLOW
47		10:25	1L	CLEAR
48		10:30	1L	CLEAR
49		9:45	250ml	LT YELLOW
50		10:30	1L	CLEAR
51		10:20	1L	CLEAR

EXTRACTION: SET UP SPE VACUUM FOR 8 SAMPLES. CARTRIGES WERE CONDITIONED WITH 10ml ACETONE AND 2x25 ml DI H_2O.

SAMPLE	START	STOP	VOLUME	COLOR
52	11:25	12:15	250ml	LT yellow
53		12:55	1L	CLEAR
54		1:00	1L	CLEAR
55		12:15	250ml	LT YELLOW
56		12:51	1L	CLEAR
57		1:00	1L	CLEAR
58		12:45	250ml	LT YELLOW
59		1:00	1L	CLEAR

RDX:

DILUTED SAMPLE 46 + 49 (1:5) AFTER SPLITTING INTO 2X 5ml FRACTIONS.

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	11:48	12:08
500		
44		
45		
46	11:53	12:13
47		
48		
49	11:59	12:19
50		
51		

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	13:25	13:50
500	13,26	13:51
44	13:27	1352
45	13:28	13:53
46	13:29	13:54
47	13:30	13:55
48	13:30	13:56
49	13:31	13:57
50	13:32	13:58
51	13:33	13:59

UV
D-198

EXTRACTION

SAMPLE	START	STOP	VOLUME	COLOR
60	2:00	3:35	1L	CLEAR
61		3:40	250	LT YELLOW
62		3:45	1L	CLEAR
63		3:30	1L	CLEAR
63MS		3:40	1L	CLEAR
MB		3:45	1L	CLEAR
BS		3:40	1L	CLEAR
64		3:45	1L	CLEAR

63MS + BS WERE FORTIFIED WITH 1ml OF RDX/TNT SPIKE SOLUTION (25ppb)

SAMPLES #52, #55, AND #58 RDX FRACTION WERE DILUTED 1:5 BEFORE COLOR DEVELOPMENT.

RDX COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	15:10	15:35
50D	15:11	15:36
52	15:12	15:37
53	15:13	15:38
54	15:14	15:39
55	15:15	15:40
56	15:16	15:41
57	15:17	15:42
58	15:18	15:43
59	15:18	15:44

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	16:15	
500		
52		
53		
54		
55	16:21	
56		
57		
58		
59		

TNT COLOR DEVELOPMENT

RB	4:45	5:05
500ppb		
MB 10/31		
~~BS 10/31~~		
BS ~~MA~~ 10/31		
60	4:60	5:10
61		
62		
63		
63MS	4:55	5:15
64		

UV

D-200

RDX CD

SAMPLE	START	STOP
RB	5:26	5:51
500	5:28	5:53
MB	5:30	5:55
BS	5:31	5:56
60	5:32	5:57
61	5:34	5:59
62	5:35	6:00
63	5:36	6:01
63MS	5:37	6:02
64	5:38	6:03

SAMPLE 63MS CONTAINED ZINC DURING COLOR DEVELOPMENT STAGE (25MIN) ZINC WAS FILTERED IN THROUGH SYRINGE BY ACCIDENT.

REEXTRACT SAMPLES #60, 61, 62, 63, 63MS, AND 64 FOR RDX FRACTION. ~~Very~~ PROBLEMS WITH COLOR DEVELOPMENT WITH ALL QC FROM THIS EXTRACTION BATCH (RDX ONLY).

Dm 10/31/97

11/1/93

SETUP SPE VACUUM ~~MANIFOL~~ MANIFOLD TO EXTRACT 8 SAMPLES. THE SPE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25 ml ALIQUOTS OF ~~H~~ H_2 WATER.

SAMPLE	START	STOP	VOL. EXTRACTED	COLOR
#65	09:40	10:29	250 ml	LIGHT YELLOW
#66		11:29	1L	CLEAR
#67		11:32	1L	CLEAR
#68		10:16	250 ml	LIGHT YELLOW
#69		11:15	1L	CLEAR
#70		~~11:~~ 11:32	1L	CLEAR
#71		10:52	250 ml	LIGHT YELLOW
#72		11:25	1L	CLEAR

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
65	12:20	12:40
66	12:20	12:40
67	12:27	12:47
68	12:27	12:47
69	12:27	12:47
70	12:27	12:47
71	12:31	12:51
72	12:31	12:51
RB	12:20	12:40
500 ppb	12:20	12:40

UV

D-202

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
72	~~1:21~~ 1:41	2:04
RB	1:43	2:08
500	1:45	2:10
65	1:46	2:11
66	1:47	2:12
67	1:49	2:14
68	1:50	2:15
69	1:51	2:16
70	1:54	2:19
71	1:55	2:20

DILUTED SAMPLE 68 + 72 (1:5) AFTER SPLITTING INTO 2X 5ml FRACTIONS.

SETUP 8 SPE CARTRIDGES FOR EXTRACTION. THE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25ml ALIQUOTS OF WATER

SAMPLE	VOLUME EXTRACTED	START	STOP	COLOR
60*	1L	14:24	16:09	CLEAR
61*	250ml	↓	15:27	YELLOW
64*	1L		15:55	CLEAR
73	1L		~~15:55~~ 16:05	CLEAR
74	250ml		15:32	YELLOW
75	1L		16:10	CLEAR
76	1L		16:08	CLEAR
77	250ml		15:33	YELLOW

* EXTRACT FOR RDX FRACTION ONLY.

UV
D-203

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	5:15	5:40
500 ppb	5:16	5:41
60	5:17	5:42
61	5:18	5:43
64	5:19	5:44
73	5:20	5:45
74	5:21	5:46
75	5:22	5:47
76	5:23	5:48
77	5:24	5:49

500 ppb standard was: .250 ml RDX in 10 ml Acetonitrile w/ 300 ul of DI H_2O

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	17:54	18:14
500		18:15
73		18:15
74		18:16
75	16:01	18:22
76		18:22
77		18:23

UV

D-204

DMW 11/1/93

11/2/93

EXTRACTION: SET UP SPE VACUUM MANIFOLD WITH 8 SAMPLES. THE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE & 2 x 25 ml OF DI H_2O

SAMPLE	START	STOP	VOLUME	COLOR
78	8:35	10:30	1L	CLEAR
79	↓	10:30	1L	CLEAR
80		9:15	250 ml	LT YELLOW
81		10:00	1L	CLEAR
82		10:30	1L	CLEAR
83		9:15	250 ml	LT YELLOW
84		9:15	250 ml	LT YELLOW
84MS	↓	9:15	250 ml	LT YELLOW

#84 MS (SAMPLE) WAS FORTIFIED W/ 1ml OF TNT/RDX SPIKE SOL 25ppm

TNT COLOR DEVELOPMENT:

SAMPLE	START	STOP
RB	11:35	11:55
500	↓	11:56
78		11:57
79		11:58
80	↓	11:58
81	11:41	12:02
82	↓	12:03
83		12:03
84		12:04
84ms	↓	12:04

UV

D-205

EXTRACTION: SET UP SPE VACUUM MANIFOLD WITH 8 SAMPLES. THE CARTRIGES WERE CONDITIONED WITH 10ml OF ACETONE & 2x25ml OF DI H_2O.

SAMPLE	START	STOP	VOLUME	COLOR
* 62	11:30	1:30	≈ 950ml	CLEAR
63	11:30	1:30	1L	CLEAR
63MS	↓	1:25	1L	CLEAR
85	↓	1:30	1L	CLEAR
86	↓	1:35	1L	CLEAR
87	↓	12:15	250ml	LT YELLOW
MB 11/2	↓	1:30	1L	CLEAR
BS 11/2	↓	1:30	1L	CLEAR

*SAMPLE #62 HAD A CRACK IN BOTTLE AND APPROX 50ml OF SAMPLE LEAKED OUT. THERE WERE NO ADDITIONAL SAMPLES TO RERUN ANALYSIS

63MS AND BS 11/12 WERE FORTIFIED WITH 1ml OF 25ppm TNT/RDX SPIKE SOLUTION.

SAMPLE 80, 83, 84 AND 84 MS RDX FRACTION WERE DILUTED 1:5 (1ml → 5ml) AFTER SPLITTING THE 10ml EXTRACT FOR RDX AND TNT ANALYSES.

UV

D-206

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	13:07	13:33
500	13:08	13:34
78	13:08	13:34
79	13:09	13:35
80	13:10	13:36
81	13:11	13:37
82	13:12	13:38
83	13:13	13:40
84	13:14	13:41
84 ms	13:15	13:42

~~SAM~~ RDX FRACTION OF SAMPLE #87 WAS DILUTED 1:5 (1ml → 5ml).

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	15:07	15:39
500	15:08	15:40
MB 11/2	15:09	15:41
BS 11/2	15:10	15:41
62	15:11	15:42
63	15:13	15:43
63 ms	15:13	15:44
85	15:~~14~~	15:45
86	15:15	15:46
87	15:16	15:47

UV

D-207

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	3:46	4:06
SUD		
MB		
BS		
85	3:52	4:12
86		
87		

ul).

UV

D-208

DMW 11/2/93

11/3/93

SETUP 8 SPE EXTRACTION CARTRIDGES FOR EXTRACTION. THE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25ml ALIQUOTS OF WATER.

SAMPLE	VOLUME EXTRACTED	TIME START	TIME STOP	COLOR
88	1L	09:34	10:40	CLEAR
89	1L	↓	10:52	CLEAR
90	250ml	↓	10:25	LIGHT YELLOW
91	1L	↓	10:45	CLEAR
92	1L	↓	11:19	CLEAR
93	250ml	↓	10:11	LIGHT YELLOW
94	1L	↓	11:23	CLEAR
95	1L	↓	11:06	CLEAR

TNT COLOR DEVELOPMENT

Sample	START	STOP
RB	12:07	12:27
500ppm	↓	↓
88	↓	↓
89	↓	↓
90	12:14	12:34
91	↓	↓
92	↓	↓
93	↓	↓
94	12:17	12:37
95	↓	↓

UV
D-209

SETUP ~~8~~ 7 SPE ~~CART~~ EXTRACTION CARTRIDGES FOR EXTRACTION

THE CARTRIDGES WERE CONDITIONED WITH 10 ml OF ACETONE AND 2 25 ml ALIQUOTS OF WATER.

SAMPLE	VOLUME EXTRACTED	TIME START	TIME STOP	COLOR
MB 11/3	1L	12:25	14:27	CLEAR
BS 11/3	1L	↓	14:20	CLEAR
96	250 ml	↓	13:00	LIGHT YELLOW
97	1L	↓	13:50	CLEAR
98	1L	↓	14:10	CLEAR
99	1L	↓	13:58	CLEAR
99 MS	1L	↓	14:16	CLEAR

BS 11/3 AND 99 MS WERE FORTIFIED WITH 1 ml OF TNT AND RDX SPIKING SOLUTION.

RDX COLOR DEVELOPMENT

RB	1:35	~~1:55~~ 2:00
500 ppm	1:34	1:59
88	1:37	2:02
89	1:38	2:03
90	1:39	2:04
91	1:40	2:05
92	1:41	2:06
93	1:42	2:07
94	1:43	2:08
95	1:44	2:09

UV

D-210

[redacted]

RDX COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	3:27	3:52
SOD	3:24	3:49
MB	~~3:25~~ 3:28	3:53
BS	~~3:26~~ 3:29	3:54
96 (1:5)	~~3:27~~ 3:30	3:55
97	~~3:28~~ 3:31	3:56
98	~~3:29~~ 3:32	3:57
99	~~3:30~~ 3:33	3:58
99MS	~~3:31~~ 3:34	3:59

TNT COLOR DEVELOPMENT

SAMPLE	START	STOP
RB	15:59	16:23
SOD		16:23
MB		16:24
BS		16:25
96		16:26
97	16:05	16:28
98		16:28
99		16:29
99MS		16:29

DMW 11/3/93

Note: the following raw data are
the spectrometer strip chart
printouts for standard, QC
samples and field samples
analyzed from 10/6/93. KGP
thru 11/3/93

UV

D-212

PHOTOMETRY/RDX 10/06/93 11:15

	ID	ABS	CONC	F
# 7	1	0.238	5245	
	2	0.042	1080	
	3	0.013	420.8	
	4	0.016	512.7	
	5	0.007	242.7	
	6	0.001	115.1	

Auto AUTOZEROED AFTER ANALYSIS

PHOTOMETRY/RDX 10/06/93 12:44

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/06/93 12:44

	ID	ABS	CONC	F
# 12	1	0.000	-66.13	LO
	2	0.001	109.8	
	3	0.011	345.7	
	4	0.021	629.8	
	5	0.013	428.4	
	6	0.007	242.7	
	7	0.034	908.4	
19	8	0.016	501.6	
	9	0.042	390.8	
	10	0.013	420.8	
	11	-0.010	-1488	LO
	12	0.010	308.1	
	13	0.067	1614	
	14	0.048	1210	
	15	0.035	947.4	
27	16	0.046	1184	

MB RDX 10/6
BSTD 1

PHOTOMETRY/TNT 10/06/93 16:26

	ID	ABS	CONC	F
# 28	1	0.011	314.1	
	2	-0.001	8.103	
	3	0.018	478.5	
	4	0.017	456.6	
	5	0.021	523.8	
	6	0.022	547.9	
34	7	0.020	509.3	

PHOTOMETRY/TNT 10/12/93 08:58

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/12/93 09:18

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/12/93 09:19

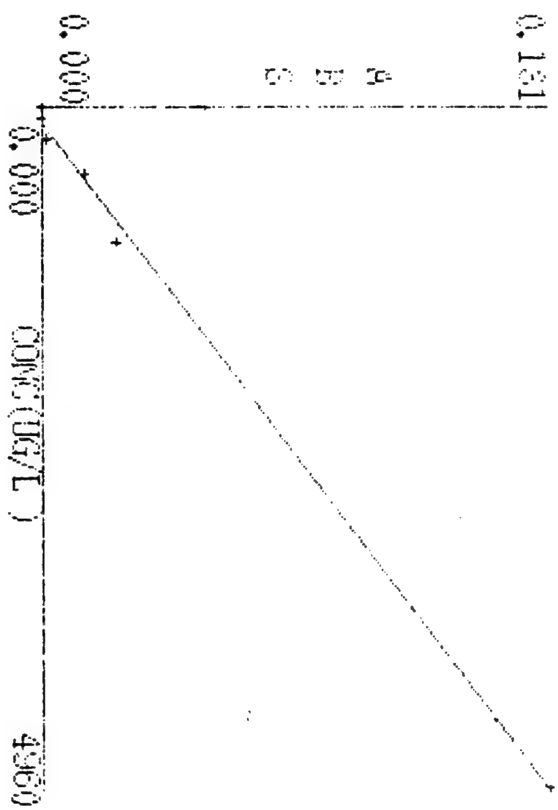
ID	ABS	CONC
STD 1	0.000	0.000
STD 2	0.001	99.20
STD 3	0.002	248.0
STD 4	0.011	496.0
STD 5	0.020	992.0
STD 6	0.131	4960

K= **** A0= -0.002

PHOTOMETRY/RDX 10/12/93 15:41

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/12/93 15:41



UV

D-214

PHOTOMETRY/RDX 10/12/93 15:43

ID	ABS	CONC	F
1	-0.002	-1289	1.0
2	0.017	846.1	
3	0.068	2727	
4	0.032	1428	
5	0.025	1166	
6	0.045	1908	

PHOTOMETRY/TNT 10/12/93 16:29

ID	ABS	CONC	F

PHOTOMETRY/TNT 10/12/93 16:29

ID	ABS	CONC	F
1	-0.001	-24.70	1.0
2	0.000	-4.939	1.0
3	0.020	436.5	
4	0.001	19.76	
5	0.015	315.9	
6	0.159	3426	
7	0.148	3187	
8	0.169	3644	
9	0.168	3623	

UV

D-215

PHOTOMETRY/RDX 10/13/93 17:01

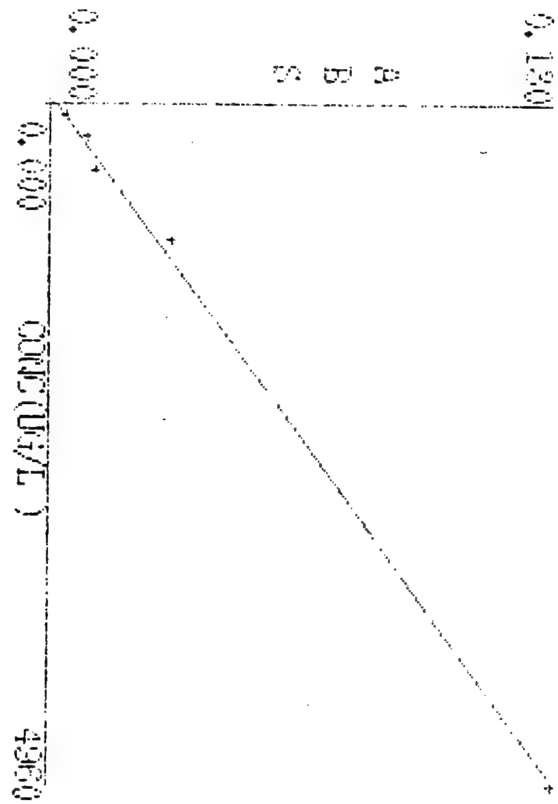
ID	ABS	CONC
STD 1	0.000	0.000
STD 2	0.005	99.20
STD 3	0.011	248.0
STD 4	0.013	496.0
STD 5	0.032	992.0
STD 6	0.130	4960

K= **** A0= 0.003

PHOTOMETRY/RDX 10/13/93 17:08

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/13/93 17:08



UV
D-216

PHOTOMETRY/RDX 10/13/93 19:15

ID		ABS	CONC	F
#9	1	0.012	385.8	
	2	0.018	616.8	
	3	-0.001	-46.99	LO
	4	0.019	655.0	
	5	0.062	2216	
	6	0.060	2117	
	7	0.041	1367	
#16	8	-0.001	-46.99	LO

PHOTOMETRY/TNT 10/13/93 19:37

ID		ABS	CONC	F
#18	1	0.001	19.76	
	2	0.019	425.1	
	3	0.014	304.4	
	4	0.150	3230	
	5	0.123	2640	
	6	0.035	743.4	
#24	7	-0.011	-247.0	LO

#17 in logbook is reagent blank autozero.

PHOTOMETRY/TNT 10/14/93 08:04

ID		ABS	CONC	F
#1	1	0.000	0.000	LO
	2	0.021	453.8	
	3	0.142	3044	
	4	0.043	906.4	
	5	-0.002	-54.34	LO
	6	0.136	2927	
	7	0.258	5572	HI
	8	-0.002	-69.15	LO

PHOTOMETRY/RDX 10/14/93 13:00

ID		ABS	CONC	F
D9	1	0.000	0.000	LO
	2	0.012	385.8	
	3	0.099	3697	
	4	0.003	46.99	
	5	0.215	8375	HI
	6	0.094	3499	
	7	0.036	1140	
#16	8	0.043	1426	

UV

D-217

PHOTOMETRY/INT 10/14/93 15:41

	ID	ABS	CONC	F
#17	1	0.000	-9.879	LO
	2	0.017	361.9	
	3	-0.003	-83.98	LO
	4	0.007	138.7	
	5	0.118	2534	
	6	-0.002	-54.34	LO
	7	0.003	54.34	
	8	0.004	64.21	
	9	-0.002	-69.15	LO
	10	0.122	2613	
	11	0.019	425.1	
28	12	-0.006	-143.2	LO

PHOTOMETRY/RDX 10/14/93 17:36

	ID	ABS	CONC	F
#29	1	0.000	-10.44	LO
	2	0.013	502.3	
	3	0.013	508.7	
	4	0.015	540.5	
	5	-0.001	-36.54	LO
	6	0.028	883.9	
	7	0.059	2066	
	8	-0.001	-41.77	LO
	9	0.000	-20.88	LO
	10	0.055	1920	
	11	0.002	31.33	
40	12	-0.003	-88.76	LO

PHOTOMETRY/INT 10/14/93 20:03

	ID	ABS	CONC	F
41	1	0.000	-9.879	LO
	2	0.019	413.6	
	3	0.112	2385	
	4	0.131	2810	
	5	0.156	3346	
	6	-0.003	-79.03	LO
47	7	0.118	2534	
	8	0.125	2667	
	9	0.138	2953	
	10	-0.291	-5913	LO
	11	-0.007	-163.0	LO
	12	-0.060	-1234	LO
	13	-0.012	-261.8	LO
54	14	0.004	69.15	

PHOTOMETRY/RDX 10/14/93 21:09

	ID	ABS	CONC	F
55	1	0.000	-10.44	LO
	2	0.010	235.0	
	3	0.002	36.54	
	4	0.062	2206	
	5	0.009	189.8	
60	6	0.021	705.8	
	7	0.050	1715	
	8	0.038	1219	
	9	0.029	903.0	
	10	0.001	15.66	
65	11	0.012	358.2	

UV

D-218

PHOTOMETRY/TNT 10/15/93 09:16

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/15/93 10:16

ID	ABS	CONC	F	
1	0.000	-5.221	LO	
2	0.009	189.8		
3	0.003	57.43		
4	0.006	112.1		
5	0.018	616.8		
6	0.097	3637		
7	0.002	41.77		
8	0.005	105.7		
9	0.017	604.1		
10	0.096	3578		
11	0.000	-10.44	LO	
12	0.020	680.4		
13	0.108	4072		
14	0.021	712.2		
15	0.096	3578		
16	0.000	-5.221	LO	
17	0.014	515.1		500 PPB
18	0.004	67.87		
19	0.015	553.2		
20	0.094	3499		
21	0.000	-5.221	LO	RB
22	0.000	-5.221	LO	
23	0.003	52.21		
24	0.064	2275		#123
25	0.080	2917		
26	0.004	78.31		
27	0.000	0.000	LO	

PHOTOMETRY/TNT 10/15/93 17:44

ID	ABS	CONC	F	
28 1	0.014	298.7		500 PPB
2	0.000	-14.81	LO	RB
3	0.103	2188		
4	0.026	665.9		
5	-0.026	-543.3	LO	
6	0.091	1928		
7	0.066	1402		
8	-0.032	-661.9	LO	
36 9	0.000	-4.939	LO	RB
10	0.021	471.0		500 PPB
11	-0.001	-39.51	LO	
12	0.016	344.6		
13	0.156	3362		
14	0.028	599.5		
15	-0.008	-172.8	LO	

UV

D-219

PHOTOMETRY/RDX. 10/15/93 20:56

ID	ABS	CONC	F	
43 1	0.000	-5.221	LO	R3
2	0.002	36.54		500 PPB
3	-0.003	-93.98	LO	
4	0.008	163.9		
5	0.019	661.3		
6	-0.003	-93.98	LO	
7	0.000	-20.88	LO	

PHOTOMETRY/TNT 10/16/93 07:51

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/16/93 12:52

ID	ABS	CONC	F	
1	0.000	-20.88	LO	
2	0.004	78.31		500 PPB
3	0.119	4506		
4	0.000	0.000	LO	
5	0.000	0.000	LO	
6	0.041	1357		
7	0.019	661.3		
8	0.000	-15.66	LO	
9	0.032	992.0		
10	0.000	-5.221	LO	
11	0.025	801.2		
12	0.008	170.4		
13	0.422	****	HI	
14	0.034	1091		1000 PPB
15	0.035	1101		1500 PPB ← use

PHOTOMETRY/TNT 10/16/93 14:53

ID	ABS	CONC	F	
#16 1	0.000	-4.939	LO	
2	0.021	471.0		500 PPB
3	0.148	3176		
4	0.005	88.91		
5	-0.001	-24.70	LO	
6	0.133	2858		
7	-0.002	-59.27	LO	
8	0.137	2937		
9	-0.006	-133.3	LO	
25 10	0.129	2773		
11	0.032	681.0		
12	-0.007	-167.9	LO	
13	0.000	-9.879	LO	
14	0.012	252.7		

PHOTOMETRY/RDX 10/16/93 17:19

	ID	ABS	CONC	F	
30	1	0.000	0.000	LO	
	2	0.016	578.7		500 PPB
	3	-0.002	-57.43	LO	
	4	0.017	604.1		
	5	0.058	2038		
35	6	-0.002	-73.09	LO	
	7	0.007	138.0		
	8	0.040	1298		
	9	0.006	118.6		
	10	0.019	655.0		
40	11	0.113	4269		
	12	0.000	-5.221	LO	
	13	0.000	-20.88	LO	

PHOTOMETRY/TNT 10/16/93 18:32

	ID	ABS	CONC	F	
44	1	0.015	321.7		500 PPB
	2	0.016	338.9		~~500 PPB~~
	3	0.000	-19.75	LO	
	4	0.136	2927		
	5	0.000	-4.939	LO	
	6	0.904	74.09		
50	7	0.000	0.000	LO	
	8	0.113	2422		
	9	0.042	672.9		
	10	0.137	2932		
	11	0.002	29.64		
55	12	-0.001	-34.57	LO	
	13	-0.001	-34.57	LO	
	~~14~~	~~-0.001~~	~~-29.63~~	~~LO~~	

PHOTOMETRY/TNT 10/17/93 09:04

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/17/93 10:35

ID	ABS	CONC	F	
1	0.000	-5.221	LO	
2	0.014	521.4		500 PPB
3	0.070	2542		
4	0.010	235.0		
5	0.006	131.5		
6	0.043	1456		
7	0.036	1140		
8	0.659	****	HI	
9	0.071	2561		
10	0.006	112.1		
11	0.175	6766	HI	
12	0.109	4111		
13	0.009	202.7		

UV

PHOTOMETRY/TNT 10/17/93 14:07

ID		ABS	CONC	F
14	1	0.000	0.000	LO
	2	0.017	367.6	500
	3	0.146	3123	
	4	0.000	-14.81	LO
	5	0.001	4.940	
	6	0.133	2852	
20	7	0.042	882.4	
	8	0.001	4.940	
	9	0.103	2199	
	10	0.052	1078	
	11	0.000	-14.81	LO
25	12	0.149	3192	
	13	0.047	988.0	

PHOTOMETRY/RDX 10/17/93 17:25

ID		ABS	CONC	F
27	1	0.000	-10.44	LO
	2	0.017	591.4	500
	3	-0.002	-57.43	LO
30	4	0.014	521.4	
	5	-0.001	-31.32	LO
	6	0.004	83.54	
	7	0.001	5.221	
	8	0.066	2354	
35	9	0.020	686.8	
	10	0.004	67.87	

PHOTOMETRY/TNT 10/17/93 18:59

ID		ABS	CONC	F
37	1	0.000	-4.939	LO
	2	0.020	442.3	500
	3	0.000	0.000	LO
40	4	0.016	338.9	
	5	0.076	1609	
	6	0.098	2093	
	7	0.001	4.940	
	8	0.160	3447	
45	9	0.258	5567	HI
	10	-0.001	-29.63	LO
	11	0.000	-14.81	LO
	12	0.026	561.1	500
	13	0.176	3782	
50	14	0.038	810.5	
	15	0.001	9.879	
	16	0.129	2767	
	17	0.042	892.0	
	18	-0.001	-39.51	LO
56	19	0.159	3426	
	20	0.133	2847	
	21	0.001	19.76	

UV

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PHOTOMETRY/RDX 10/17/93 20:36

	ID	ABS	CONC	F	
59	1	0.000	-5.221	10	
	2	0.007	157.4		500
60	3	0.089	3312		
	4	0.006	131.5		
	5	0.363	****	HI	
	6	0.057	2009		
	7	0.006	125.1		
65	8	0.004	73.09		
	9	0.063	2246		
	10	0.012	358.2		
	11	0.036	1150		

Note: Data from 10/11/93
Not in
chronological order

PHOTOMETRY/TNT 10/11/93 15:45

ID	ABS	CONC	F	
1	0.004	69.15		MB
2	0.052	1084		BS #1
3	0.053	1110		BS #2
4	0.330	7134	HI	
5	0.374	8085	HI	
6	0.309	6688	HI	
7	0.028	599.5		500 PPB TNT
8	0.012	264.2		
9	0.525	****	HI	

PHOTOMETRY/TNT 10/11/93 15:00

ID	ABS	CONC
STD 1	0.000	0.000
STD 2	0.005	98.80
STD 3	0.012	247.0
STD 4	0.022	494.0
STD 5	0.047	988.0
STD 6	0.229	4940

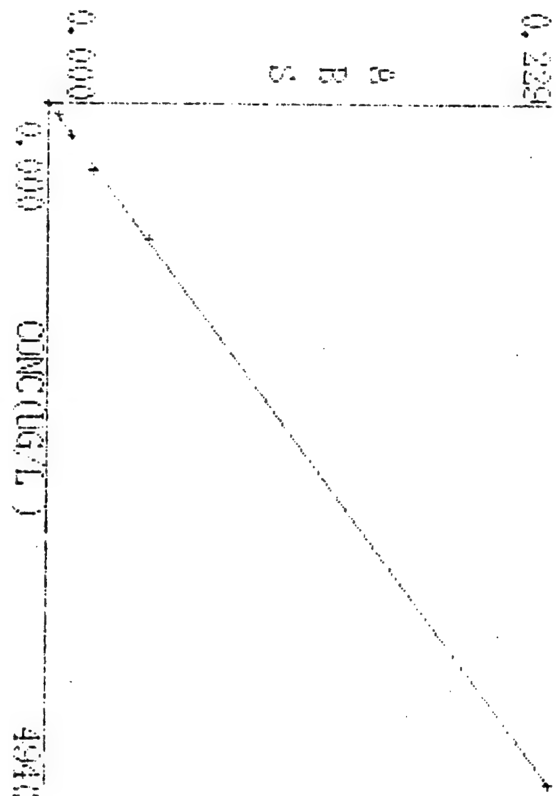
r = 0.9999

K- **** A0= 0.000

PHOTOMETRY/TNT 10/11/93 15:43

ID	ABS	CONC	F

PHOTOMETRY/TNT 10/11/93 15:44



PHOTOMETRY/TNT 10/11/93 15:44

N= 192 MEAN= 879.8 SD= 819.4 CV= 93.14

UV

D-224

PHOTOMETRY/TNT 10/18/93 16:50

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/18/93 16:52

ID	ABS	CONC

PHOTOMETRY/TNT 10/18/93 16:58

ID	ABS	CONC	F
7 1	0.001	4.940	
2	0.000	-9.879	LO
3	0.020	448.0	
10 4	0.016	356.1	
5	-0.007	-167.9	LO
6	0.010	218.5	
7	0.131	2799	
8	0.005	98.91	
9	-0.007	-153.1	LO
10	0.172	3697	
11	0.016	350.4	
12	-0.001	-39.51	LO
13	0.098	2093	
14	0.109	2321	
15	0.178	3824	
16	0.034	719.4	
17	-0.004	-98.80	LO

PHOTOMETRY/RDX 10/18/93 17:57

ID	ABS	CONC

PHOTOMETRY/RDX 10/18/93 17:59

ID	ABS	CONC	F
24 1	0.001	10.44	
2	0.000	-5.221	LO
3	0.007	138.0	
4	0.004	63.54	
5	0.035	1140	
6	0.075	2719	
7	0.006	131.5	
8	0.007	144.5	
9	0.154	5927	
10	0.009	209.2	
11	0.074	2680	
12	0.192	7447	HI
13	0.097	3627	
14	0.148	5700	
15	0.016	565.9	
16	0.011	330.7	

PHOTOMETRY/TNT 10/18/93 10:19

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/18/93 14:25

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/18/93 14:28

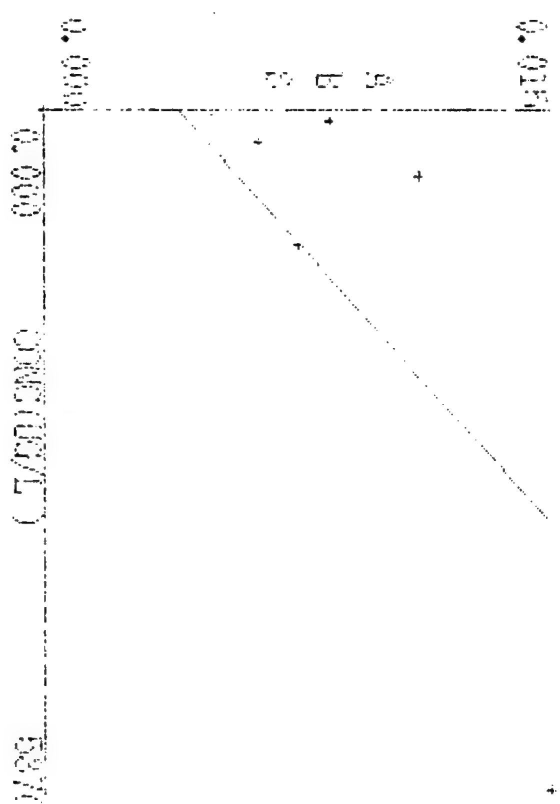
ID	ABS	CONC
STD 1	0.000	0.000
STD 2	0.009	107.4
STD 3	0.007	268.5
STD 4	0.011	537.0
STD 5	0.008	1074
STD 6	0.015	5370

K= **** A0= 0.694

PHOTOMETRY/RDX 10/18/93 16:02

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/18/93 16:03



UV

D-226

PHOTOMETRY/TNT 10/19/93 08:24

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/19/93 11:46

ID	ABS	CONC	F
1	0.000	-10.44	LO
2	0.005	88.75	
3	0.006	118.6	
4	0.007	138.0	
5	0.002	41.77	
6	0.003	57.43	
7	0.003	52.21	
8	0.017	597.7	

PHOTOMETRY/TNT 10/19/93 16:44

	ID	ABS	CONC	F
9	1	-0.001	-49.40	LO
10	2	0.000	-4.939	LO
	3	0.000	-14.81	LO
	4	0.003	49.40	
	5	0.016	350.4	
	6	0.012	252.7	
15	7	0.021	465.3	
	8	0.158	3400	
	9	0.158	3400	
	10	-0.002	-69.15	LO
	11	0.115	2465	
20	12	0.174	3745	
	13	-0.002	-59.27	LO
	14	0.239	5163	
	15	0.560	****	HI
	16	-0.005	-118.5	LO
25	17	0.014	293.0	

PHOTOMETRY/RDX 10/19/93 17:36

	ID	ABS	CONC	F
26	1	0.000	-5.221	LO
	2	0.000	-5.221	LO
	3	0.010	228.6	
	4	0.021	718.5	
30	5	0.064	2285	
	6	0.083	3055	
	7	0.002	26.10	
	8	0.058	2058	
	9	0.081	2956	
35	10	0.005	88.75	
	11	0.063	2255	
	12	0.114	4299	
	13	0.000	-10.44	LO

UV

D-227

PHOTOMETRY/TNT 10/27/93 12:54

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/27/93 14:36

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/27/93 14:39

#	ID	ABS	CONC
1	STD 1	0.000	0.000
2	STD 2	0.005	107.4
3	STD 3	0.002	268.5
4	STD 4	0.016	537.0
5	STD 5	0.020	1074
6	STD 6	0.171	5370

K= **** A0= -0.004

PHOTOMETRY/RDX 10/27/93 14:53

ID	ABS	CONC	F

PHOTOMETRY/TNT 10/27/93 15:34

ID	ABS	CONC	F

PHOTOMETRY/TNT 10/27/93 15:40

	ID	ABS	CONC
7	STD 1	0.000	0.000
8	STD 2	0.004	100.4
9	STD 3	0.012	251.0
10	STD 4	0.022	502.0
11	STD 5	0.038	1004
12	STD 6	0.225	5020

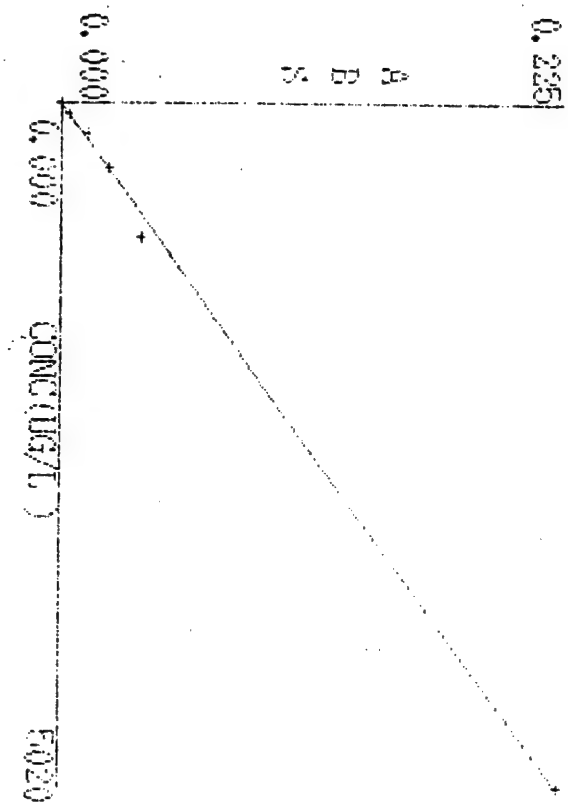
K= **** A0= -0.001

PHOTOMETRY/TNT 10/27/93 15:54

ID	ABS	CONC	F

UV

PHOTOMETRY/TNT 10/27/93 15:56



PHOTOMETRY/RDX 10/27/93 15:59

ID	ABS	CONC

PHOTOMETRY/RDX 10/27/93 16:00

ID	ABS	CONC

PHOTOMETRY/RDX 10/27/93 16:02

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/27/93 16:02

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/27/93 16:03

ID	ABS	CONC

PHOTOMETRY/RDX 10/27/93 16:03

	ID	ABS	CONC	F
13	1	0.004	79.13	
14	2	0.011	281.0	
15	3	0.006	121.4	
16	4	0.027	1262	

UV

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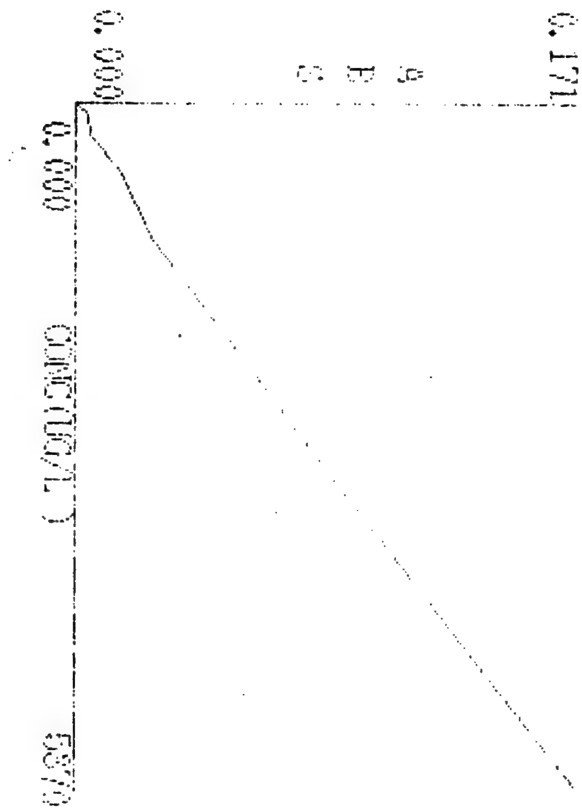
507.0nm 0.027A
507.0nm 0.027A

PHOTOMETRY/RDX 10/27/93 18:01

ID	ABS	CONC	F

PHOTOMETRY/RDX 10/27/93 18:02



UV

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50

PHOTOMETRY/TNT 10/28/93 10:01

	ID	ABS	CONC	F	
	1	0.000	0.000	LO	RO
	2	0.030	749.1		
	3	0.028	687.3		
	4	0.023	532.9		500
	5	0.034	880.4		
	6	0.020	442.5		
	7	0.012	242.4		
	8	0.145	3307		
	9	0.196	4393		
	10	-0.008	-213.3	LO	
	11	-0.008	-207.0	LO	
	12	0.005	121.9		
	13	0.000	6.275		
	14	0.013	264.2		
	15	0.037	973.1		
	16	0.022	517.4		
	17	0.016	343.5		
	18	0.134	3072		
	19	0.185	4163		
	20	-0.003	-100.4	LO	
	21	-0.003	-87.85	LO	
	22	0.025	617.8		
	~~23~~	~~0.001~~	~~18.82~~		
	~~24~~	~~0.015~~	~~317.0~~		
	~~25~~	~~0.024~~	~~586.9~~		
	~~26~~	~~0.006~~	~~130.5~~		
	~~27~~	~~0.001~~	~~37.65~~		
	~~28~~	~~0.061~~	~~1500~~		
	~~29~~	~~-0.004~~	~~-106.6~~	~~LO~~	
	~~30~~	~~0.006~~	~~134.8~~		
	~~31~~	~~0.004~~	~~100.4~~		
	~~32~~	~~0.011~~	~~[illegible]~~		

PHOTOMETRY/RDX 10/28/93 16:18

	ID	ABS	CONC	F
32	1	0.000	-5.652	LO
	2	0.019	685.5	
	3	0.028	1113	
35	4	0.004	84.79	
	5	-0.001	-28.26	LO
	6	0.093	3051	
	7	0.007	284.4	
	8	-0.004	-118.7	LO
40	9	0.001	22.61	
	10	0.022	816.7	
	11	0.005	96.09	
	12	0.003	56.52	
	13	0.021	757.1	
45	14	-0.001	-39.55	LO
	15	0.000	-11.30	LO
	16	0.006	197.5	
	17	0.000	-5.652	LO
	18	0.020	745.1	
50	19	0.004	90.44	
51	20	0.204	6350	
	21	-0.004	-118.7	LO
	22	-0.005	-135.6	LO
	23	0.112	3619	
55	24	-0.003	-84.79	LO

UV

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PHOTOMETRY/TNT 10/28/93 18:34

ID	ABS	CONC	F
56 1	0.001	25.10	
2	0.022	525.2	
3	0.001	31.37	
4	0.019	429.3	
60 5	0.000	-12.55	LO
6	0.004	94.12	
7	0.006	139.1	
8	-0.001	-50.20	LO
9	0.003	69.02	
65 10	0.035	911.3	

PHOTOMETRY/TNT 10/29/93 09:07

ID	ABS	CONC	F

PHOTOMETRY/TNT 10/29/93 12:05

ID	ABS	CONC	F
1	0.001	18.82	
2	0.000	6.275	
3	0.021	475.6	
4	0.000	-12.55	LO
5	0.004	94.12	
6	0.000	-12.55	LO
7	-0.001	-31.37	LO
8	0.004	104.7	
9	0.010	199.4	
10	-0.002	-75.30	LO
11	0.005	126.2	

PHOTOMETRY/RDX 10/29/93 12:28

ID	ABS	CONC	F
10 1	0.000	-5.652	LO
2	0.010	382.7	
3	0.019	661.7	
15 4	0.250	7719	HI
5	-0.001	-28.26	LO
6	0.009	356.5	
7	0.230	7130	HI
8	-0.004	-124.3	LO
20 9	-0.001	-28.26	LO
10	0.097	3160	
11	0.001	5.652	
12	0.000	0.000	LO
13	0.020	721.3	
25 14	0.006	242.6	
15	0.001	22.61	
16	0.319	9788	HI
17	0.370	****	HI
18	0.410	****	HI
30 19	0.001	16.96	
20	1.062	****	HI
21	0.224	5962	

UV

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PHOTOMETRY/TNT 10/29/93 16:17

ID	ABS	CONC	F
33 1	0.000	-6.275	LO
2	0.018	409.5	
35 3	0.019	435.9	
4	0.018	389.7	
5	0.000	6.275	
6	0.005	113.3	
7	0.004	109.0	
40 8	0.009	182.1	
9	0.001	25.10	
10	-0.001	-25.10	LO
11	0.004	94.12	
12	0.000	12.55	
45 13	0.025	594.7	
14	0.000	-6.275	LO
15	0.019	435.9	
16	0.003	69.02	
17	-0.001	-25.10	LO
50 18	0.005	121.9	
19	0.015	330.3	
20	-0.001	-43.92	LO
53 21	0.005	113.3	

PHOTOMETRY/RDX 10/29/93 18:48

ID	ABS	CONC	F
54 1	-0.001	-29.26	LO
55 2	0.000	0.000	LO
3	0.014	481.0	
4	0.002	45.22	
5	0.046	1631	
6	0.001	5.652	
60 7	0.006	197.5	
8	0.458	****	HI
9	0.003	62.18	
10	0.006	271.3	
11	0.678	****	HI

UV

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PHOTOMETRY/TNT 10/30/93 11:10

ID	ABS	CONC	F
1	0.000	0.000	LO
2	0.022	502.0	
3	-0.001	-25.10	LO
4	-0.000	-12.55	LO
5	0.004	100.4	
6	0.000	-12.55	LO
7	-0.001	-43.92	LO
8	0.002	62.75	
9	0.007	152.0	
10	-0.001	-50.20	LO

PHOTOMETRY/RDX 10/30/93 13:09

	ID	ABS	CONC	F
11	1	0.001	11.30	
	2	0.000	-5.652	LO
13	3	0.005	107.4	500
	4	0.007	297.5	
15 ~~25~~	5	0.037	1361	
	6	1.180	****	HI
17	7	0.005	101.7	
	8	0.002	28.26	
	9	1.124	****	HI
20	10	-0.001	-28.26	LO
	11	0.000	-11.30	LO
	12	0.017	590.2	500
23	13	0.000	-11.30	LO
	14	0.028	1099	
25	15	0.940	****	HI
	16	0.005	96.09	
	17	0.007	304.0	
	18	0.004	90.44	
	19	0.036	1354	
30	20	0.894	****	HI

PHOTOMETRY/TNT 10/30/93 16:56

	ID	ABS	CONC	F
31	1	0.000	6.275	
	2	0.025	617.8	
	3	0.002	62.75	
	4	0.020	449.2	
35	5	0.004	100.4	
	6	0.000	6.275	
	7	0.001	37.65	
	8	0.000	-6.275	LO
	9	0.018	402.9	
	10	0.005	117.6	

UV

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PHOTOMETRY/TNT 10/31/93 10:39

ID	ABS	CONC	F
1	0.000	0.000	LO
2	0.022	525.2	
3	0.001	18.82	
4	0.001	18.82	
5	0.006	130.5	
6	0.006	130.5	
7	0.000	-6.275	LO
8	0.005	117.6	
9	-0.001	-37.65	LO
10	-0.001	-18.82	LO

PHOTOMETRY/RDX 10/31/93 12:41

	ID	ABS	CONC	F
11	1	0.000	-11.30	LO
	2	0.01[illegible]	554.4	
	3	0.004	73.48	
	4	0.165	5207	
15	5	0.212	6605	
	6	0.010	389.3	
	7	0.005	96.09	
	8	0.256	7909	HI
	9	0.016	542.5	
20	10	0.106	3422	
	11	0.000	-5.652	LO
	12	0.010	376.2	
	13	0.176	5505	
	14	1.394	****	HI
25	15	0.010	382.7	
	16	0.178	5571	
	17	0.021	792.8	
	18	0.005	152.5	
	19	0.206	6408	
30	20	0.012	441.7	

PHOTOMETRY/TNT 10/31/93 16:42

	ID	ABS	CONC	F
31	1	0.000	6.275	
	2	0.021	482.2	
	3	0.004	104.7	
	4	0.000	-12.55	LO
35	5	0.000	-12.55	LO
	6	0.005	126.2	
	7	0.000	-6.275	LO
	8	0.000	-12.55	LO
	9	0.005	126.2	
40	10	0.015	317.0	
	11	0.000	6.275	
	12	0.028	695.1	
	13	0.002	50.20	
	14	0.015	310.4	
45	15	0.002	62.75	
	16	0.009	190.8	
	17	0.019	435.9	
	18	0.016	350.1	
	19	0.037	996.3	
50	20	-0.001	-43.92	LO

UV

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PHOTOMETRY/RDX 10/31/93 17:35

	ID	ABS	CONC	F
51	1	0.000	-16.95	LO
	2	0.030	1150	
	3	0.001	16.96	
	4	0.024	935.8	
55	5	0.014	494.2	
	6	0.354	****	HI
	7	0.005	152.5	
	8	-0.003	-90.44	LO
	9	-0.004	-113.0	LO
60	10	0.014	474.5	

UV

PHOTOMETRY/TNT 11/01/93 08:26

	ID	ABS	CONC	F
	1	0.000	12.55	
	2	0.023	540.6	
	3	0.005	126.2	
	4	-0.054	1364	
	5	0.004	94.12	
	6	0.001	37.65	
	7	0.004	109.0	
	8	0.004	104.7	
	9	0.000	-12.55	LO
	10	0.002	62.75	
	11	0.010	212.3	

PHOTOMETRY/RDX 11/01/93 13:33

	ID	ABS	CONC	F
12	1	0.000	-11.30	LO
	2	0.009	343.4	
	3	0.267	8236	HI
	4	-0.003	-101.7	LO
16	5	-0.001	-39.56	LO
	6	0.197	6154	
	7	-0.003	-96.09	LO
	8	-0.005	-146.9	LO
20	9	0.254	7836	HI
	10	0.000	-16.95	LO
	11	0.000	0.000	LO
	12	0.008	330.3	
	13	0.003	56.52	
25	14	0.323	9912	HI
	15	0.003	62.18	
	16	0.003	67.83	
	17	0.008	317.2	
	18	0.336	****	HI
30	19	-0.001	-33.91	LO
	20	0.001	22.61	
	21	0.351	****	HI
	22	0.000	-11.30	LO
34	23	0.021	780.9	

PHOTOMETRY/TNT 11/01/93 18:25

	ID	ABS	CONC	F
35	1	0.000	12.55	
	2	0.025	602.4	
	3	0.004	100.4	
	4	0.001	25.10	
	5	0.075	1808	
40	6	-0.003	-87.85	LO
41	7	-0.001	-37.65	LO

PHOTOMETRY/TNT 11/02/93 08:04

ID	ABS	CONC	F
1	0.000	12.55	
2	0.021	488.8	
3	-0.006	143.4	
4	0.000	-6.275	LO
5	0.003	69.02	
6	0.011	233.8	
7	-0.001	-25.10	LO
8	0.006	139.1	
9	0.003	87.85	
10	0.007	147.7	

PHOTOMETRY/RDX 11/02/93 13:29

ID	ABS	CONC	F
1	0.000	-11.30	LO
2	0.005	101.7	
3	-0.002	-62.17	LO
4	0.015	369.6	
5	0.173	5418	
6	-0.003	-96.09	LO
7	-0.001	-45.22	LO
8	0.222	6904	
9	0.070	2359	
20 10	0.284	8739	HI
11	0.000	-11.30	LO
12	0.003	62.18	
13	-0.002	-67.83	LO
14	0.013	461.4	
25 15	0.000	-11.30	LO
16	-0.001	-56.52	LO
17	0.005	96.09	
18	0.054	1878	
19	0.011	408.9	
30 20	0.119	3830	

PHOTOMETRY/TNT 11/02/93 16:05

ID	ABS	CONC	F
1	0.000	6.275	
2	0.018	402.9	
3	0.000	-6.275	LO
4	0.021	475.6	
35 5	0.072	1740	
6	-0.001	-25.10	LO
7	0.006	139.1	

UV

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PHOTOMETRY/TNT 11/03/93 10:03

ID	ABS	CONC	F
1	0.001	18.82	
2	0.034	880.4	
3	0.032	826.3	
4	0.001	37.65	
5	0.002	43.92	
6	0.014	290.6	
7	0.017	369.9	
8	-0.001	-31.37	LO
9	0.003	87.85	
10	0.002	56.47	
11	-0.001	-18.82	LO
12	0.022	525.2	

PHOTOMETRY/RDX 11/03/93 13:52

ID	ABS	CONC	F
1	0.000	-5.652	LO
2	0.016	554.4	
15 3	0.058	1995	
4	0.005	107.4	
5	0.267	8222	HI
6	0.177	5549	
7	0.009	349.9	
20 8	0.232	7188	HI
9	0.784	****	HI
10	0.008	330.3	
11	0.001	5.652	
12	0.001	5.652	
25 13	0.009	349.9	
14	0.000	-5.652	LO
15	0.021	769.0	
16	0.114	3670	
17	0.003	50.87	
30 18	0.008	323.7	
19	0.007	284.4	
20	0.015	520.4	

PHOTOMETRY/TNT 11/03/93 16:24

ID	ABS	CONC	F
1	0.000	0.000	LO
2	0.021	495.4	
35 3	0.021	495.4	
4	0.000	-6.275	LO
5	0.015	323.7	
6	0.002	43.92	
7	0.001	31.37	
40 8	-0.001	-43.92	LO
9	-0.001	-50.20	LO
10	0.010	216.6	

UV

11/3/93

End of Lab Notes

UV

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